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AMPHIBIANS AND REPTILES OF SOUTHERN FLORIDA

William E. Duellman and Albert Schwartz



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AMPHIBIANS AND REPTILES OF SOUTHERN FLORIDA

WILLIAM E. DUELLMAN

and

ALBERT SCHWARTZ¹

SYNOPSIS: The 85 species of reptiles and amphibians known to occur in southern peninsular Florida and the Florida Keys are treated systematically. The discussion for each species includes data on variation, ecology, life history, habits, and distribution. The definition of geographic races in southern Florida has been accomplished only after extensive analyses of the variation encountered throughout the peninsula. The area of study is broken down into six major habitats; the distribution of the species in these habitats is analyzed. Ideas on the origin and relationships of the herpetofauna of southern Florida are assayed on the basis of a knowledge of the history of the peninsula and Florida Keys and on what is known of the relationships of the component species of the herpetofauna.

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¹William E. Duellman is an Instructor in the Department of Biology at Wayne State University, Detroit, Michigan. (This paper is contribution No. 13 from that department.) He also is associated with the Museum of Zoology at the University of Michigan, where the work on this study was done; he completed the study under a grant from the National Academy of Sciences in 1957. Albert Schwartz is an Instructor in the Department of Biology at Albright College, Reading, Pennsylvania. The collections for the present study were made while he was a student at the Museum of Zoology at the University of Michigan. Manuscript submitted 14 January 1958.—Ed.

INTRODUCTION

The southern tip of the Florida peninsula with its adjoining chain of islands, the Florida Keys, represents the only area in continental United States wherein semitropical and even tropical conditions prevail. The peninsula also represents a cul-de-sac for animals from the north and a springboard for those from the West Indies. However, man has also moved into southern Florida in great numbers, and in recent years he has wrought destruction to many of the natural habitats, so that many square miles of the "Big Cypress" have passed through the sawmill and no longer provide a mysterious abode for the "lurking denizens of the swamp." The Everglades have been burned and drained, and once where great bull alligators bellowed at night and huge flocks of snowy egrets and roseate spoonbills fed in the marshes by day, large herds of Brahman cattle now dot the landscape. In places oil derricks interrupt the flatness of the sawgrass prairies and stand as monuments to human exploitation. Many of the most beautiful and extensive tropical hammocks in the Miami area have been hewed away to make room for homes. Already it is too late to learn of many of the intimate relations between the animals and their natural environment.

Our original intention was to present the accumulated data on the amphibians and reptiles of southern Florida in a manner that would be usable not only for the herpetologist, but for the layman as well. With the appearance of Carr and Goin's "Guide to the reptiles, amphibians, and fresh-water fishes of Florida" in 1955, this plan was abandoned; consequently, the material is embodied in this technical report.

This study grew out of the collections of amphibians and reptiles made by the junior author while he was studying the mammals of southern Florida. He spent the springs and summers of 1951 and 1952 in that area. Even a cursory examination of his extensive collections showed the need for additional material and extensive field work to untangle many problems concerning the herpetofauna. Both of us worked in the field in the summer of 1953, during which time we attempted to collect adequate series of many species and to determine the geographical distribution of all of the forms. Our field work was repeated in the summer of 1954, at which time the emphasis was placed on gathering ecological data. The only other major field work was a winter excursion to the Florida Keys by the junior author and L. Neil Bell in 1953. The field work resulted in the collection of several thousand herpetological specimens, of which

4740 were deposited in the University of Michigan Museum of Zoology; smaller numbers were deposited in the University of Miami reference collection and in the Charleston Museum. These added to previously existing specimens in various museums in the United States make a total of 8562 specimens from southern Florida that were examined during the course of this study.

ACKNOWLEDGMENTS

While the authors were in the field they enlisted the aid of several people for collecting specimens and called on others for information and observations. Although the entire list is too long to print here, each individual has our sincere thanks for the time and effort that helped to make this study a reality. Certain individuals must be singled out for special acknowledgment. Among these are three residents of Miami, Florida—L. Neil Bell, Dennis R. Paulson, and Raymond P. Porter. Bell, who at one time was working with the authors on this report, was responsible for the collection of large numbers of specimens and for gathering data on the distribution and life histories of many species. Paulson, through his energetic field work, greatly enlarged our collections. Porter, with his knowledge of Florida wildlife and the Everglades, was a constant source of valuable information and ideas. To these people we are deeply indebted, for had it not been for their interest and enthusiasm, much of the data presented here would still be awaiting our discovery. Other individuals deserving special mention for their assistance in the field are Ann S. Duellman, Julian Harrison, Norman Hartweg, James E. Mosimann, Daniel R. Stanland, Thomas M. Uzzell, Jr., and Harold J. Walter.

For the loan of specimens or permission to work in their respective institutions we wish to thank Charles M. Bogert, American Museum of Natural History; Doris M. Cochran, United States National Museum; the late Emmett R. Dunn, Academy of Natural Sciences of Philadelphia; Coleman J. Goin and Duke Wilder, University of Florida; Arthur Loveridge, Museum of Comparative Zoology; Wilfred T. Neill, Ross Allen Reptile Institute; M. Graham Netting and Neil Richmond, Carnegie Museum; Oscar T. Owre, University of Miami; William J. Hamilton, Jr. and C. Richard Robins, Cornell University; the late Karl P. Schmidt, Chicago Natural History Museum; and Hobart M. Smith, University of Illinois. In one way or another Walter Auffenberg, Roger Conant, Richard Edgren, Arnold B. Grobman, William Haast, and M. B. Mittleman have helped with certain

problems. Irving J. Cantrall, Fred G. Thompson, and Harold J. Walters of the University of Michigan Museum of Zoology, and H. F. Strohecker of the University of Miami, identified invertebrate remains from stomach contents. Pierre Dansereau, formerly of the University of Michigan and now of the Université de Montréal, greatly assisted the senior author in formulating the ecological section of this report; a preliminary paper on this aspect of the study was presented at the meetings of the American Institute of Biological Sciences and the American Society of Ichthyologists and Herpetologists in Gainesville, Florida, in 1954.

All of the senior author's work on this project was done at the University of Michigan Museum of Zoology. Sincere thanks are due to Norman Hartweg, T. H. Hubbell, the late J. Speed Rogers, and Charles F. Walker for not only placing at his disposal the facilities of the institution, but for suggestions and assistance during the course of the study. The photographs of preserved specimens were taken by William L. Brudon, those of habitats in southern Florida by the senior author and his wife. All of the other illustrations are the work of the senior author.

We are indebted to Daniel B. Beard, Superintendent, Everglades National Park, for permission to collect in the area under his jurisdiction. Financial support for field work in southern Florida was furnished by the Museum of Zoology University of Michigan. The study was completed by the senior author under a grant from the Bache Fund of the National Academy of Sciences.

AREA OF STUDY

In this study we have concerned ourselves only with the southern tip of the Florida peninsula and the adjacent Florida Keys. Of course, reference is made to the area to the north, but the northern boundary of the present survey consists of an imaginary line from Fort Lauderdale to Naples. We have endeavored to examine all specimens from this area and to visit every accessible part of the region (fig. 1).

PHYSIOGRAPHY AND GEOLOGY

The following brief account of the physiographic and geological features of southern Florida is based on our personal field experience and on the works of Bryan and Stoutamire (1930), Cooke (1945), Henderson (1939), Parker and Cooke (1944), and Schuchert (1929, 1935).

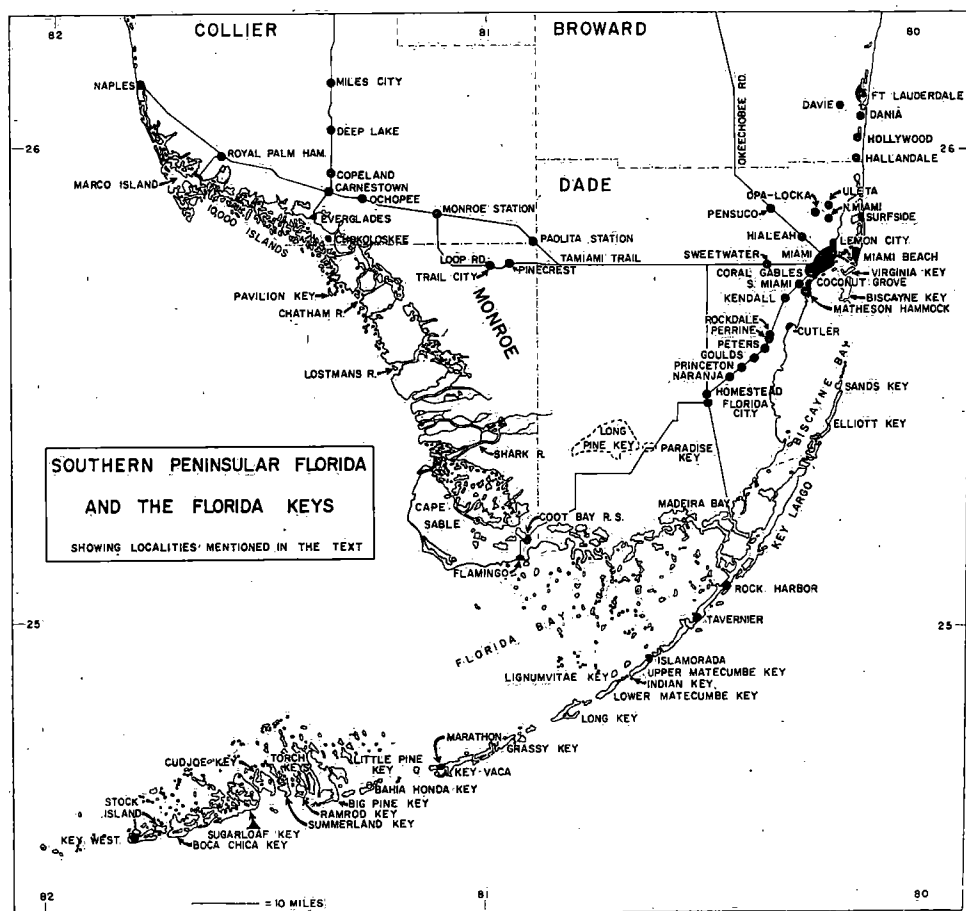


Figure 1.—Map of southern Florida showing county boundaries, principal roads, and place names.

The whole of southern Florida, according to most geologists, has but recently emerged from the sea. The Pamlico beachline of the Wisconsin now stands at 25 feet above present sea level, and since no place on the southern Florida mainland has an elevation that high above sea level, it has been assumed that all of southern Florida must have been beneath the sea until late Wisconsin time. The relief in southern Florida is slight. Aside from sand dunes on Marco Island that reach a height of 55 feet above the sea, the highest land is the east coast ridge or rock rim which averages about 12 feet above sea level. To the west this ridge slopes fairly abruptly to the

interior lowlands, which become gradually higher at their western edge before sloping downward into the Gulf of Mexico. In this low interior there is also a gradual slope from Lake Okeechobee southward to Florida Bay, so that actually this low region is a broad, shallow river draining the Okeechobee Basin. The Florida Keys are also low in elevation, and it is doubtful if any are over 20 feet above the sea.

Most of the Pleistocene deposits in southern Florida are underlain by the Tamiami formation of middle Pliocene age; this formation is on the surface in the southwestern part of the peninsula and in small areas between Miami and Fort Lauderdale; in other parts of southern Florida it underlies the Miami oölite, the Fort Thompson formation, and the Key Largo limestone. The Tamiami formation is a calcareous sandstone apparently deposited in the open sea in rather shallow water far away from land (fig. 2).

The Fort Thompson formation is an alternating freshwater marl and limestone, and marine shell marl. It contains three separate marine shell beds possibly corresponding to the Aftonian, Yarmouth, and Sangamon interglacial periods of the Pleistocene. The intervening freshwater beds were deposited during the Kansan and Illinoian glacial stages. This formation extends from the south shore of Lake Okeechobee to central Broward County.

The Key Largo formation, a coral limestone, was formed from a coral reef developed during the Sangamon interglacial period and may be slightly older than or contemporaneous with the Miami oölite. This formation extends from Sands Key on the north to Bahia Honda Key on the south.

The Miami oölite, an oölitic limestone, also is supposedly of Sangamon age. The formation was deposited in shallow water at a time when the peninsula north of Lake Okeechobee had emerged, but all of southern Florida was still under water. The ocean currents shaped the oölitic ooze into a broad, slightly curving bar that now forms the eastern rim of the southern part of the peninsula, and that at one time formed a continuous land mass from Volusia County to Key West. The Miami oölite is extensive throughout the southeastern part of the peninsula and forms the lower keys from, but not including, Bahia Honda Key westward. In many places the soft oölitic limestone is at the surface where it weathers to form pot holes and pits.

The Pamlico sand was deposited during a submergence in Wisconsin time. A more or less thin sheet of this sand was deposited over all of southern Florida. In some places it has been eroded away,

but for the most part it is overlain by recent beach and estuarine deposits. The Lake Flirt marl is widely distributed in the Everglades where it underlies the peaty accumulations and overlies the Pamlico sand. This marl has accumulated in freshwater lakes probably since late Wisconsin (post-Pamlico) time and may have continued to do so locally up to recent time.

Sandy soils derived from the Pamlico sand are prevalent along the west coast as far south as Marco Island and on the east coast to Miami. The sandy soils are present on the eastern rim extending southwestward from Miami. These sands are porous, hold little

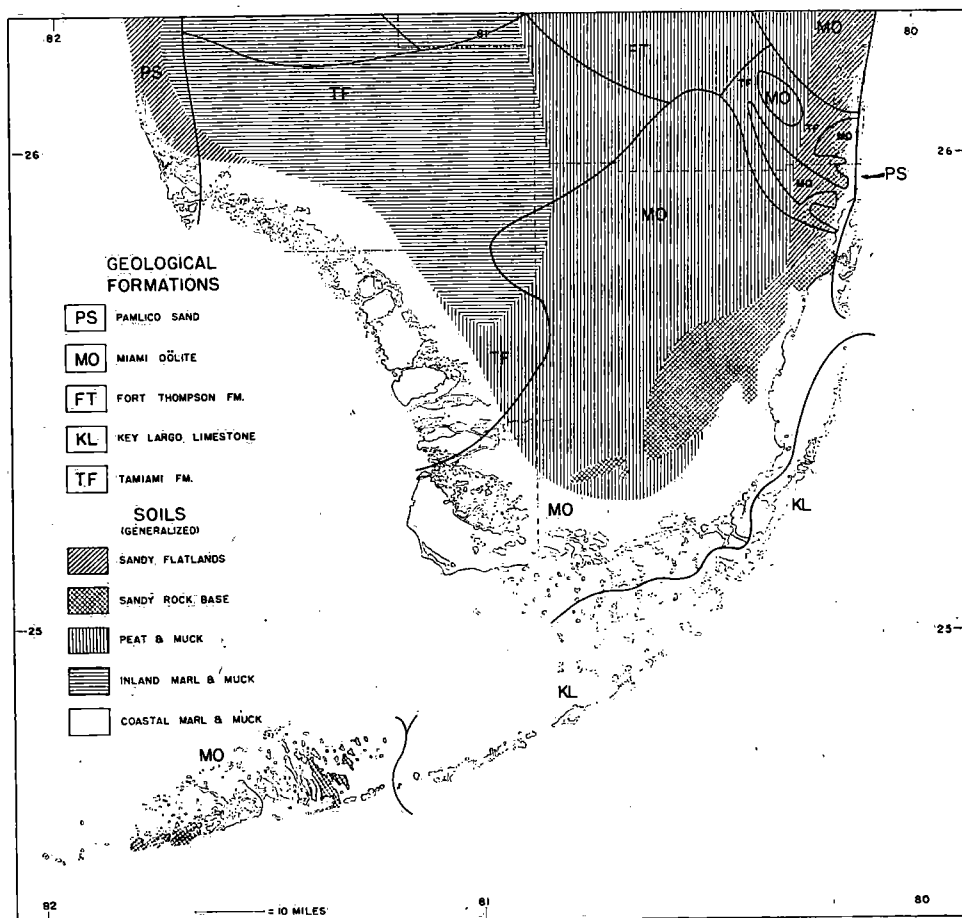


Figure 2.—Map of southern Florida showing geological formations and soil types.

moisture, and are slightly acidic. There are fine-textured sand beaches along both coasts, but on the keys such beaches are small and localized. The region of the Everglades and associated wet prairies has a rich peat and muck soil accumulated from the vegetation. This slightly alkaline soil lies on the Lake Flirt marl and is under water for considerable periods of time throughout the year. Thin muck deposits on the Lake Flirt marl cover most of the western part of the peninsula. It is on these alkaline soils that the interior pine forests and cypress forests are developed. The coastal regions not covered by sand beaches are composed of calcareous marls that are alkaline in nature. Highly organic soils have accumulated as small islands in the Everglades and in depressions in the sandy soils. On these rich soils dense growths of hardwoods (hammocks) are found.

CLIMATE

The climate of southern Florida is an equable one with hot, wet summers, and mild winters with reduced precipitation. Frost has been reported occasionally on the mainland, but never on the keys. The warm winters can be attributed to the Gulf Stream, which closely follows the east coast, and to the large inland bodies of water, the Everglades. The average January temperature in Miami is 68° F., and in July it is 81.7° F. Comparative temperatures for Key West are 69° F. in January and 83.2° F. in July (Mitchell and Ensign, 1928). Rainfall is higher on the mainland than on the keys; for example, the average annual rainfall in Miami is 60 inches, on Long Key 42 inches, and on Key West 38 inches. The greatest amount of rainfall is during the summer months, culminating with the heaviest rains in September and October—the hurricane season. Hurricanes are almost of annual occurrence in some parts of the state. These tropical storms with winds of high velocity and heavy rains cause extensive wind damage and flooding. The flooding of the Everglades makes it necessary for all but the most aquatic animals to seek higher ground, either the hammocks or the elevated roadbeds.

VEGETATION AND ANIMAL HABITATS

In contrast with the low relief and the equable climatic conditions, southern Florida presents a diversity of environmental conditions. The arrangement and location of vegetation types present in southern Florida are due primarily to edaphic conditions. The notes on the vegetation are based on personal experience, and data presented by Braun (1950), Davis (1943), Egler (1952), Penfound (1952),

Safford (1919), and Small (1931a,b,c, 1933). The nature of the vegetation and composition of the flora are discussed under the descriptions of the various ecological situations. The classification of habitats used here is a somewhat modified and simplified version of that proposed by Davis (1943). The following classification of habitats (with the exception of VI) consists of three levels: those indicated by Roman numerals differ in the amount of moisture present; those indicated by capital letters differ in the structure of the vegetation; those indicated by Arabic numbers differ floristically. The classification of animal habitats in southern Florida is outlined as follows:²

I. XERIC

- A. Sandy scrub
- B. Pine forest
 - 1. Sandy pineland
 - 2. Rocky pineland
- C. Beaches

II. MESIC

- A. Hammocks
 - 1. Oak
 - 2. Cabbage palm
 - 3. Tropical

III. ALTERNOHYGRIC³

- A. Cypress flats
- B. Prairies
 - 1. Saw grass
 - 2. Poverty grass
 - 3. Needle grass

IV. HYGRIC

- A. Cypress heads
- B. Sink ponds
- C. Canals and rivers

V. HALOHYGRIC

- A. Salt marshes
- B. Mangrove swamps

VI. EDIFICARIAN AND RUDERAL

In the following pages the various habitats as proposed above are discussed, giving their distribution in southern Florida, soil conditions when these are known, structure of the vegetation, and a list of the dominant or more common plant species. Figure 3 shows the rough distribution of the generalized habitats.

I. XERIC

Dry conditions are quite common in southern Florida. The eastern rock rim made up of an oölitic limestone and overlain by a thin

² The terms used here to denote the major realms of ecological division do not correspond with similar terms derived by del Villar (1929).

³ The term "alternohygric" is proposed for areas in which there is alternate flooding and drying out, such as is typical of the Everglades.

cover of sand is typical of the xeric conditions. This situation also is present on the lower keys where the soil conditions are much the same. The sandy flatlands north of Miami and north of Naples, plus the greater part of Marco Island are remnants of Pleistocene beaches. Porous sandy soils that hold little moisture apparently are the controlling factors in determining the seemingly arid conditions. Pines of one species or another and the palmetto, *Serenoa repens*, are common to all xeric habitats in Florida.

A. SANDY SCRUB.—This is the *Pinus clausa*-*Ceratiola ericoides* association commonly referred to as the rosemary scrub. This associa-

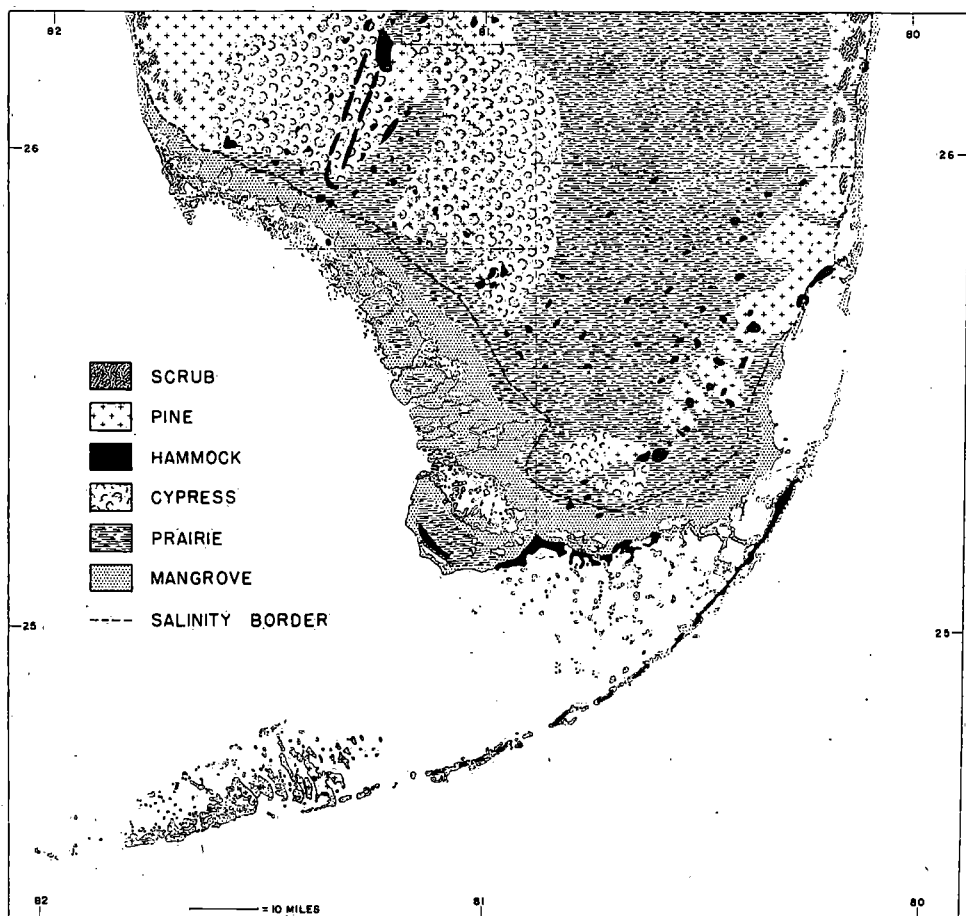


Figure 3.—Map of southern Florida showing general distribution of major types of vegetation.

tion is found on sandy flatlands. In southern Florida it is restricted to a few small patches between Miami and Ft. Lauderdale on the east coast and to scattered patches in the vicinity of Naples and Marco Island on the Gulf coast. In this habitat the pines are widely spaced, often 100 yards apart. *Ceratiola ericoides*, *Quercus myrtifolia*, and *Serenoa repens* comprise the only real cover. Sometimes these plants form dense thickets covering many square yards to a height of four or five feet. *Opuntia* is also found in this association; graminoids are local (fig. 4).

B. PINE FOREST.—Pine forests are found on the sandy soils along the east coast and Gulf coast, on the eastern rim extending southwestward from Miami, on the lower keys, and on the sandy and marly soils of the interior in the western part of the peninsula.

1. Sandy pineland.—The pine flatwoods are rather extensive in the sandy regions north of Miami and in the western part of the peninsula north and east of Naples. In these areas the pine forests have developed on ground-water podzols, such as the Pamlico sand. The pine flatwoods in the interior have developed on soils with a calcareous substratum. In the former, *Pinus caribaea* is the dominant tree (fig. 5), whereas in the latter, *Sabal palmetto* often combines with the pines to form the uppermost story, and in some places the cypress, *Taxodium ascendens*, intermingles with the pines (fig. 10). Often the forests are rather open, especially those in the interior where, as often as not, the structure of the vegetation more closely approaches that of a savanna than a forest. The understory consists of small shrubs, such as *Vaccinium myrsinites*, *Ilex glabra*, *Quercus pumila*, and *Pycnothymus*, aside from the omnipresent *Serenoa repens*. Typical graminoids in this association are *Andropogon* and *Aristida*.

2. Rocky pineland.—The pineland on the eastern rock rim formed of Miami oölite may be considered as being distinct from the sandy pineland, not in regard to the pine, but to the associated plants. The rocky pineland is nearly continuous from Ft. Lauderdale to Miami and southwest to Long Pine Key in the midst of the Everglades. The pine forests are well developed on the lower keys, especially Big Pine Key. These are open pine forests growing on an oölitic limestone covered with a thin layer of sandy soil. In many places there is no soil, so that the eroded limestone stands at the surface. The dominant plant is *Pinus caribaea* (fig. 6). Other trees, such as *Coccothrinax argentea*, *Metopium toxiferum*, and *Guettarda scabra*, are found scattered among the pines. The common grasses are *Andropogon* and *Aristida stricta*. The pine forests on the lower keys are much

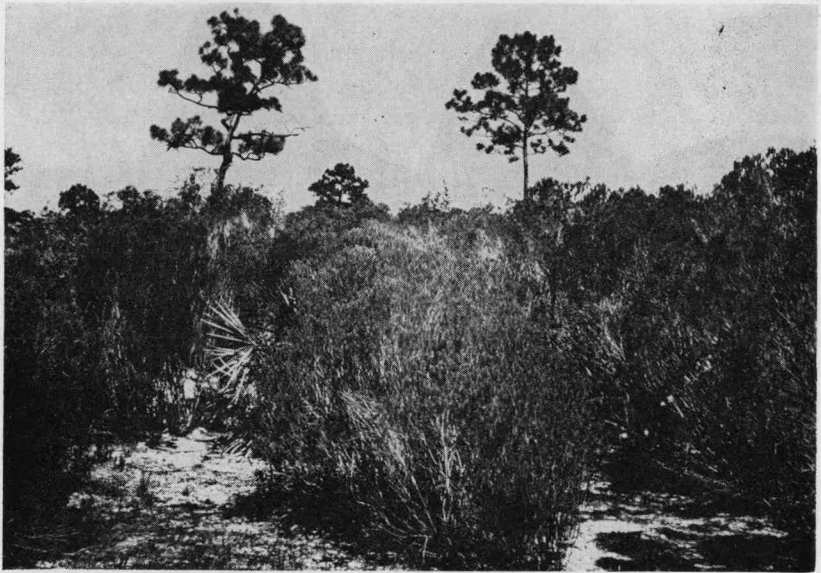


Figure 4.—Rosemary-scrub habitat on Marco Island, Collier County. In the foreground are *Ceratiola ericoides* and *Quercus myrtifolia*. The tree is *Pinus clausa*.



Figure 5.—Pine flatwoods principally composed of *Pinus caribaea*, 8 miles southeast of Naples, Collier County.



Figure 6.—Rocky pineland near Florida City, Dade County. The trees are *Pinus caribaea* and the understory *Serenoa repens*.



Figure 7.—Beach on the seaward side of Marco Island, Collier County. *Cenchrus* is the dominant plant in the foreground; in the background is *Uniola*.

the same as those on the mainland, but usually less dense. Also, *Cocos nucifera* has been introduced into the pinelands, where it forms a dominant part of the vegetation in some areas. Mesophytic hammock invades the pineland in many areas and soon becomes dominant. In southern Florida the *Pinus caribaea*-*Serenoa repens* association apparently is a fire disclimax, for in areas where the pine forests have been protected from fire, hammock vegetation is increasing to the detriment of the pine.

C. BEACHES.—Extensive fine-textured sand beaches are found from Ft. Lauderdale to Miami Beach on the east coast and in the vicinity of Naples and on Marco Island on the Gulf coast. Small sandy beaches are found on some of the Florida Keys. The principal plants include *Coccoloba uvifera*, *Uniola*, and *Cenchrus* (fig. 7). *Cocos nucifera* has been planted on the inland side of many beaches.

II. MESIC

The existence of mesic habitats in southern Florida is usually due to pockets in the marl or rock substratum in which organic soils have accumulated. Consequently, the mesic habitats are in the form of "islands" scattered throughout the Everglades and pinelands.

A. HAMMOCKS.—The term hammock in southern Florida is applied to patches of woodlands, other than pine. Hammocks may be high and relatively dry, such as oak hammocks; fairly well drained but subject to wet conditions at least during parts of the year, such as cabbage palm hammocks; or they may be in the form of a dense growth of subtropical and tropical plants that form an actual jungle, such as the tropical hammocks.

1. Oak hammock.—This type of mesic habitat is restricted to a few places on the eastern rim south of Miami, in Coral Gables, and in South Miami. *Quercus virginiana* is the dominant tree; *Ficus aurea* and *F. brevifolia* are commonly found. Other plants associated with the oak hammocks include *Coccoloba laurifolia*, *Metopium toxiferum*, and *Psychotria*; *Tillandsia* is everywhere present in the trees.

2. Cabbage palm hammock.—This type of hammock is most commonly found along the western margin of the prairies and scattered through the cypress flats and pine woods in the western part of the peninsula. In these areas the hammocks are formed on marl and muck soils. *Sabal palmetto* is the dominant plant, and in hammocks where the trees are not too dense there is an understory that may include *Serenoa repens*, *Yucca aloifolia*, and many species of small herbs (fig. 8).

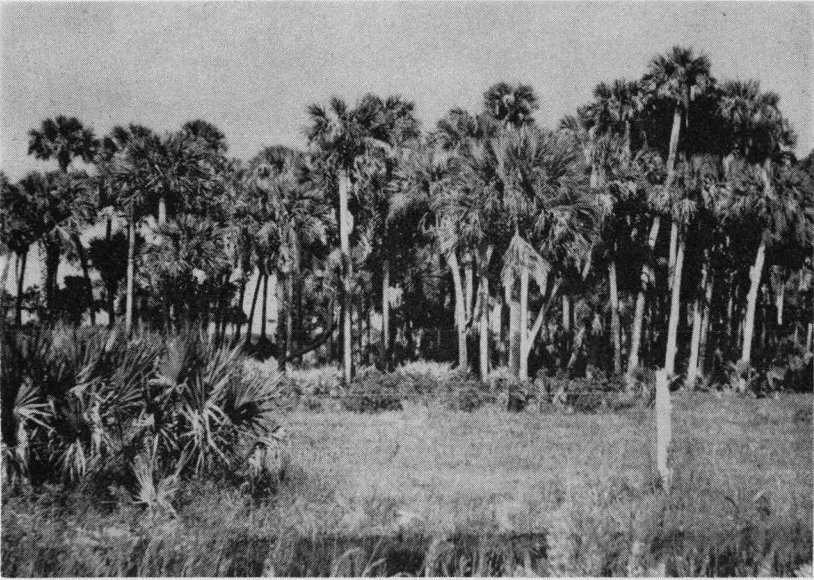


Figure 8.—Cabbage-palm hammock of *Sabal palmetto* with an understory of *Serenoa repens* near Carnestown, Collier County.

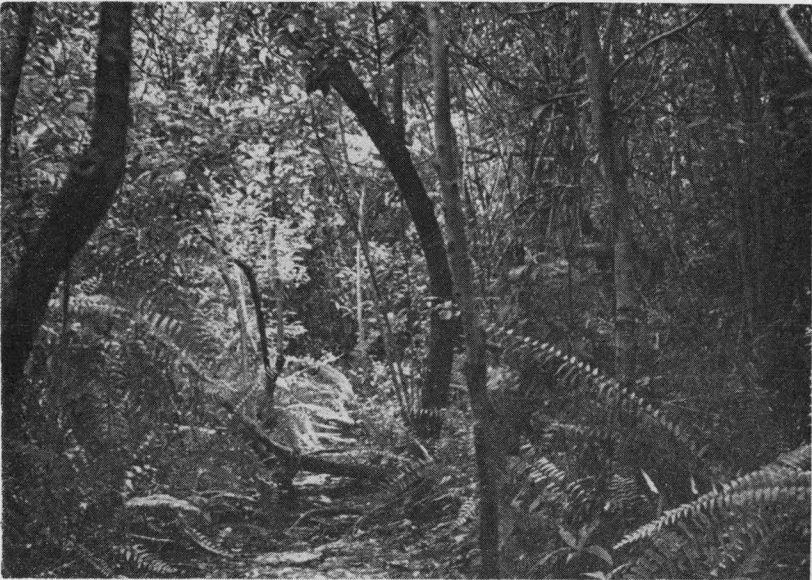


Figure 9.—Interior of a large tropical hammock on Paradise Key, Dade County. Among the plants in the picture are *Nephrolepis exaltata*, *Eugenia*, *Tamala*, *Krugiodendron*, *Psychotria*, *Pisonia*, and *Bursera*.

3. Tropical hammock.—These hammocks may be rather extensive, such as Matheson Hammock south of Coral Gables, Royal Palm Hammock, Paradise Key, and those along the southern coast and on Key Largo, or they may be small clumps of trees, such as most of the hammocks in the Everglades. These "tree islands" in the wet prairies are most common along the eastern margin of the Everglades, especially south of the Tamiami Trail. In the Everglades they have formed on ground slightly higher than the surrounding prairies; on the rock rim they are more often found in depressions in the rock where organic material has accumulated and provided a place for the luxuriant growth of trees. The floor of the hammocks is usually nearly devoid of herbaceous plants, with the exception of ferns. Instead the ground is covered with leaves and leaf mold. It is in these hammocks that the West Indian elements in the flora are most apparent, there being scores of plant species with Bahaman and Cuban affinities. A complete list of the more common and dominant plants is not feasible here, but some of the most frequently encountered and most noticeable species in the hammocks on the mainland are listed below.

<i>Bursera simaruba</i>	<i>Metopium toxiferum</i>
<i>Coccoloba laurifolia</i>	<i>Psychotria</i>
<i>Dipholis</i>	<i>Roystonea regia</i>
<i>Eugenia</i>	<i>Sideroxylon foetidissimum</i>
<i>Ficus aurea</i>	<i>Swietenia mahogani</i>
<i>Lysiloma bahamensis</i>	<i>Tillandsia</i>

Royal Palm Hammock in Collier County is a fine example of a *Roystonea* hammock; the large palms tower above the other vegetation. *Roystonea* and *Ficus* are dominant trees on Paradise Key (fig. 9). Southwest of Paradise Key is a hammock composed almost entirely of *Swietenia mahogani*. The plants comprising the hammocks on the mainland are also found in hammocks on the keys; however, more West Indian species are encountered on the keys. *Swietenia mahogani* is more common on the keys, while *Thrinax*, *Pseudotherinax sargentii*, *Guaiacum sanctum*, *Hippomane mancinella*, and *Piscidia communis* also are commonly found. The hammocks on the keys do not attain the luxuriant splendor of those on the mainland; the trees are more crowded and stunted, a condition that may be the direct result of the tropical storms that batter the islands rather frequently.

III. ALTERNOHYGRIC

The term alternohygric is applied to those environments in southern Florida that are subject to periodic flooding and drying. More



Figure 10.—Cypress flats 47 miles west of Miami, Monroe County. Here *Taxodium ascendens* mixes with *Pinus caribaea*.



Figure 11.—The Everglades or true saw-grass prairie dominated by *Mariscus jamaicensis*, as viewed from a fire tower 36 miles west of Miami, Dade County.

specifically, it is applied to the low flat interior region of the southern part of the peninsula, that region in which the wet prairies and cypress flats are found. The soils are either a combination of peat and muck or marl and muck.

A. CYPRESS FLATS.—The cypress savannas are extensive in the western part of the peninsula where they are interrupted by expanses of pineland and wet prairies. Also, scattered through the cypress savannas are tropical and cabbage palm hammocks. *Taxodium ascendens* is the only tree distributed throughout the habitat (fig. 10). *Serenoa repens* is plentiful and in certain areas forms a dense understory. The ground cover consists primarily of *Utricularia juncea*, *Cyperus Haspan*, and *Rhynchospora*.

B. PRAIRIES.—The flat grasslands of southern Florida form the most extensive vegetational formation, and it is this plant formation that has received the name "Everglades." These grasslands extend from Lake Okeechobee to Cape Sable. For the most part they are formed on peat and muck soils, and in spite of the highly organic composition of the soils the underlying limestone creates a slightly alkaline condition.

1. Saw grass.—The prairies that are made up almost entirely of *Mariscus jamaicensis* are the true Everglades. They lie in the middle of the prairie region, being bordered on each side by the poverty-grass prairies. To the south they fuse with the brackish salt marshes or mangrove swamps. The saw grass prairies are homogeneous. *Mariscus* is by far the most common plant, while *Peltandra virginica*, *Solidago fistulosa*, and *Polygonum* occur in scattered areas in much fewer numbers (fig. 11). The continuity of the saw grass marshes is interrupted only by hammocks, ponds, and canals. Open ponds in the Everglades, locally called sloughs, are usually bordered by dense growths of willow, *Salix amphibia* (fig. 12).

2. Poverty grass.—The prairies immediately bordering the higher ground—the eastern rim and the sandy flatlands to the west—are rather different floristically from the true Everglades or saw-grass prairies. In the bordering areas *Mariscus* is scarce, the vegetation being composed almost entirely of *Andropogon* and *Aristida*. A possible explanation for the floristic differences may lie in the slightly different soil conditions towards the borders of the interior lowlands; possibly *Mariscus* is able to grow only in the richest soils, these being present only in the middle of the prairie region.

3. Needle grass.—The needle-grass prairies composed almost entirely of *Eleocharis cellulosa* are found in the southeastern part of



Figure 12.—Taylor Slough at Paradise Key, Dade County. The pond is surrounded by *Salix amphibia* and *Typha*.

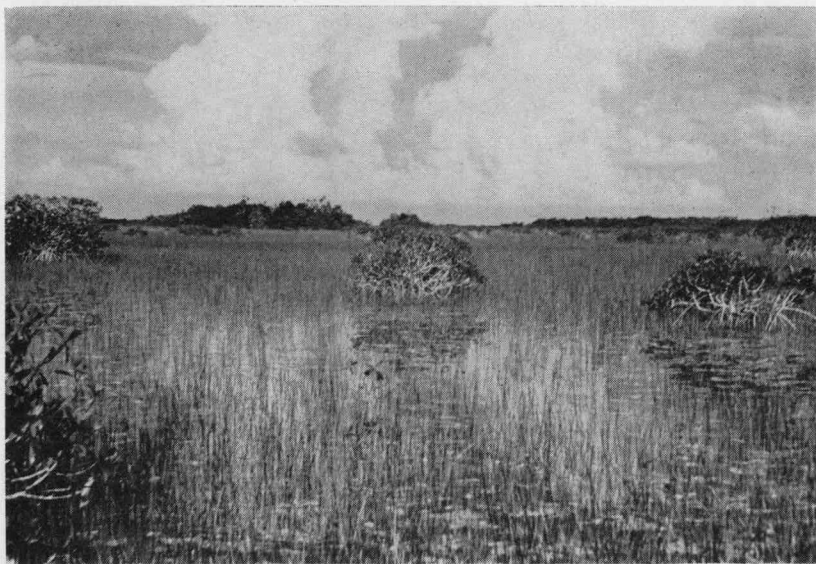


Figure 13.—Needle grass prairie, composed of *Eleocharis cellulosa*, at the salinity border in the wet season, 17.5 miles southwest of Paradise Key, Dade County. Small mangroves, *Laguncularia racemosa*, are in the foreground. Rising above the hammock in the distance are palms, *Paurotis*.

the peninsula, south and east of the rock rim that extends southwestward from Miami. Here the soils are more calcareous than those in the interior lowlands, and there is a much greater salinity effect, which is especially prominent near the coast where *Distichlis* and *Spartina* are found with the *Eleocharis*. The salinity border may be determined by the presence of the tall slender palms, *Paurotis* (fig. 13).

IV: HYGRIC

The strictly aquatic freshwater habitats in southern Florida are found naturally only in cypress ponds, sink ponds, and in the few real rivers. The most extensive freshwater habitat, however, is in the form of artificial canals, most of which parallel the roads in the area.

A. CYPRESS HEADS.—The so-called cypress heads or ponds are depressions that contain water throughout the year and support a more or less dense growth of cypress. These situations are most frequently met with west of the Everglades, but some cypress heads occur in the Everglades proper. Both *Taxodium distichum* and *Taxodium ascendens* make up the dominant vegetation in these areas (fig. 14). Associated plants are *Magnolia virginiana*, *Salix amphibia*, *Isnardia repens*, *Sagittaria*, and *Thalia geniculata*.

B. SINK PONDS.—Ponds that are the result of solution of the limestone substratum are common in central Florida, a region of typical karst topography. There are few such ponds in southern Florida; one of the largest is Deep Lake in Collier County. There are several small sinks and solution pits on the eastern rim and one large pit on Big Pine Key (fig. 15). *Nymphaea* and *Typha* are typical plants of the shores of these ponds.

C. CANALS AND RIVERS.—The network of canals in southern Florida that were built for drainage purposes form an important and extensive habitat that contains water throughout the year. The introduced water hyacinth, *Eichhornia (Piaropus) crassipes* is the dominant plant in the canals. In many places these hyacinths have become so thick that they form a solid floating mass on the surface of the water. *Typha*, *Pontederia*, *Sagittaria*, and *Nymphaea* also contribute to the canal vegetation. *Salix amphibia* and *Taxodium* are common canal-edge plants. Along the Tamiami Trail and some other roadways in southern Florida, *Casuarina equisetifolia* has been planted between the roads and the canals (fig. 16). The elevated roadbeds paralleling the canals offer a site of refuge for many animals when the prairies are flooded.



Figure 14.—Cypress pond 5.5 miles south of Monroe Station, Collier County.



Figure 15.—Solution pit on Big Pine Key, Monroe County. The vegetation surrounding the sink is composed of *Pinus caribaea* and *Serenoa repens*.

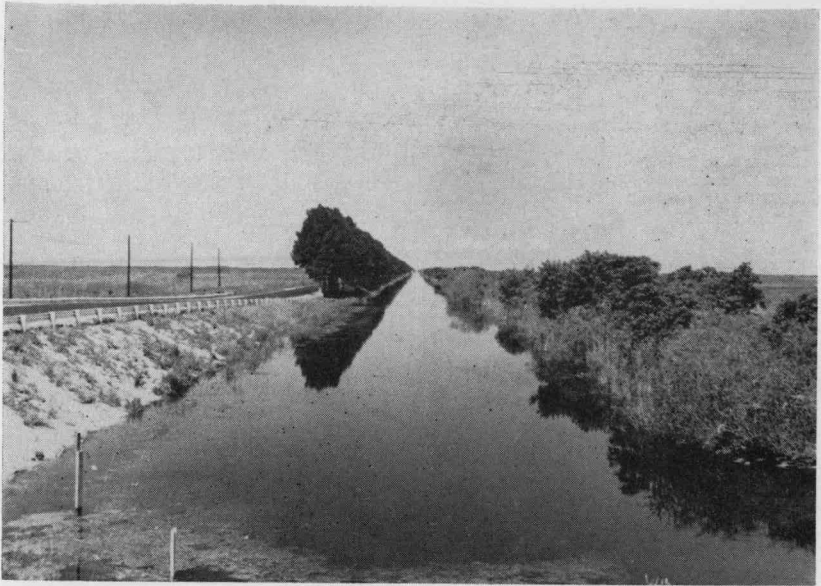


Figure 16.—The Tamiami Canal, 20 miles west of Miami, Dade County. On the right bank are *Typha* and *Salix amphibia*. On the left are planted *Casuarina equisetifolia*.



Figure 17.—Turner River, Collier County.

There are few real rivers in southern Florida. The water hyacinth usually is absent from the rivers; *Taxodium* and *Salix* are usually present along the banks; also, the banks may be lined in certain areas with tropical hammock (fig. 17).

V. HALOHYGRIC

Because there is so little relief in southern Florida, tides, storms, and rainfall cause a fluctuation of the salinity border. In the southern part of the Everglades there is a gradual transition between freshwater plant species and those commonly associated with brackish conditions.

A. SALT MARSHES.—In the southwestern part of the state brackish marshes or prairies are an intermediate stage between the freshwater prairies and the coastal mangrove swamps. These are formed on calcareous soils. The most extensive salt marsh is on Cape Sable (fig. 18). The following herbaceous plants are common in this habitat: *Distichlis spicata*, *Spartina*, *Juncus Roemerianus*, *Batis*, and *Salicornia*.

B. MANGROVE SWAMPS.—The dense tangle of mangrove swamp fringing the southern edge of the Florida peninsula and the Florida Keys is one of the most extensive in the world. The low southwestern coastal region, the Ten Thousand Islands, and the smaller keys have practically no vegetation other than mangroves, which flourish on the coastal marl. The mangroves show a definite order of succession. *Rhizophora mangle* is farthest from shore; then follows *Avicennia nitida*, *Laguncularia racemosa*, and finally *Conocarpus erecta* (fig. 19). *Batis*, *Salicornia*, and *Spartina* are found among the mangroves.

VI. EDIFICARIAN AND RUDERAL

The man-made habitats form an important factor in the distribution of many species of reptiles and amphibians in southern Florida, especially those introduced into port cities from the West Indies. Edificarian and ruderal situations are frequently inhabited by several native species as well. In many places shaded gardens and yards provide the only moist habitats available to some populations of amphibians; citrus groves and cultivated fields likewise form habitats for many species.

COMPOSITION OF THE HERPETOFAUNA

In the southern part of the Florida peninsula and on the Keys are found 80 species of amphibians and reptiles, not including five species of sea turtles. Of the 80 species, eight were undoubtedly introduced into the area, and four others may have been introduced.⁴



Figure 18.—Salt marsh on Cape Sable, Monroe County. *Distichlis*, *Spartina*, *Salicornia*, and *Batis* are present in the marsh. In the background is a tangle of mangroves.

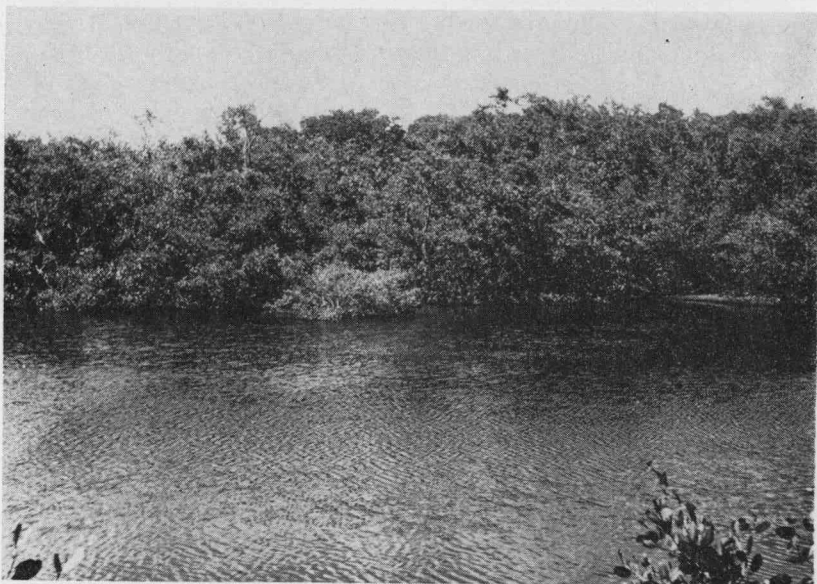


Figure 19.—Mangrove swamp (*Rhizophora mangle* is shown) on the leeward side of Marco Island, Collier County.

Thus, only 68 native species may exist. These comprise 51 genera (amphibians 12, reptiles 39), and 21 families. For a warm lowland area this is a relatively small number of species. However, an impoverished herpetofauna is what might be expected at the end of a long peninsula, through the length of which certain habitats and their inhabitants disappear. The depauperate nature of the herpetofauna is well illustrated by comparing the numbers of families, genera, and species of amphibians and reptiles known from northcentral Florida with those occurring in southern Florida. In the north are 24 families, 62 genera, and 101 species. The Ambystomidae, Plethodontidae, and Amphisbaenidae do not reach southern Florida. In the latter area are four genera and species of salamanders, as compared with ten genera and 15 species in northcentral Florida. *Crocodylus acutus* is the only species (except the introduced ones) in southern Florida that does not extend to the northern part of the peninsula. In comparison with the above figures, in all of the eastern United States there are 26 families, 75 genera, and 186 species. Although the southeastern states generally have a greater number of species of amphibians and reptiles than do the northern states, as one moves southward in peninsular Florida the number diminishes.

For obvious reasons the five sea turtles—*Chelonia mydas*, *Eretmochelys imbricata*, *Lepidochelys olivacea*, *Caretta caretta*, and *Dermochelys coriacea*—that frequent the coastal regions of the southeastern United States are not included in the above analysis.

Nine lizards and three anurans that have affinities with faunas other than that of North America are found in southern Florida. Seven lizards and two frogs have West Indian affinities: *Gonatodes fuscus*, *Sphaerodactylus argus*, *S. cinereus*, *S. notatus*, *Anolis distichus*, *A. sagrei*, *Leiocephalus carinatus*, *Eleutherodactylus ricordi*, and *Hyla septentrionalis*. Of the above species, *Leiocephalus carinatus* and *Sphaerodactylus argus* apparently are no longer extant in southern Florida. Of the other nonnative forms, *Bufo marinus* may have been introduced from almost anywhere around the Caribbean or Gulf of Mexico; *Ameiva ameiva* is from South America, and *Hemidactylus turcicus* occurs in tropical regions around the world. Four of the above species are rather widely distributed in southern Florida and inhabit natural, unmodified areas; these are *Eleutherodactylus ricordi*, *Hyla septentrionalis*, *Sphaerodactylus notatus*, and *Anolis sagrei*. Either these species have inhabited southern Florida for a much longer

* Neill (1957: 207) mentioned the presence of *Anolis equestris* in southern Florida, but did not give a locality for the species. It is not included here.

time than the others or they have certain characteristics better adapting them for life in southern Florida. *Anolis sagrei* possesses morphological differences that distinguish it from the West Indian populations. It therefore seems logical to assume that *A. sagrei* has been in Florida for a considerable length of time. The other eight species for the most part, with the exception of *E. ricordi*, are found only in port cities and appear to be recent introductions through the agency of man. *Crocodylus* may have reached southern Florida by way of the West Indies.

ECOLOGY OF THE HERPETOFAUNA

As has been shown in the section on vegetation, the area studied may be divided into five major natural habitats. Certain factors tend to impair the accurate specification of the herpetological assemblage characteristic of each of these habitats, and also the distribution of these assemblages.

First, there is the element of personal error, that is, the lack of uniformity in the study of the several habitats. Because of their inaccessibility many large but extensive tropical hammocks were not studied. The hordes of mosquitoes tested the tolerance of collectors in mangrove swamps; a minimum of time was spent there. In areas where collecting was poor, we often gave up in despair and departed for more productive localities. In some of the areas mentioned we undoubtedly missed certain species.

Second, the seasonal activity of the fauna, particularly the anurans, precludes a complete faunal picture. Although all areas in southern Florida were studied in the wet summers and in the dry winters, it was not always possible to be at the right place at the right time. The element of chance figured strongly the night we first heard *Hyla gratiosa* in southern Florida.

Third, extensive cutting, burning, draining, and other human forms of destruction unquestionably have altered patterns of distribution, possibly restricting the ranges of some species and extending those of others. This factor raises several questions: What were the distributions of aquatic and semiaquatic species prior to the building of canals? What were the distributions of species now found in the Everglades before the roadways were built and large sections of the prairies drained? These questions can never be answered; we can only hope to ascertain the present distributions on the basis of the habitats now in existence.

Finally, the principal criteria used by zoogeographers are the presence and absence of species. However, in some instances the rela-

tive abundance of some or all of the species may be as indicative of faunal similarities and differences as is the presence. We have attempted, in a rather crude fashion, to determine relative abundance, that is, noting whether a species was of apparently rare, moderate, or abundant occurrence in a given habitat.

In presenting the following picture of the local distribution of the herpetofauna in southern Florida, we have attempted to weigh our data and observations with full knowledge of the sources of possible error. In some instances our interpretations have been based more on our observations of the species outside of the area of

TABLES 1 and 2

DISTRIBUTION OF NONMARINE REPTILES AND AMPHIBIANS OF SOUTHERN FLORIDA

Species	1. Distribution by major habitats						2. Distribution by geographic regions		
	Xeric	Mesic	Alternohygic	Hygic	Halohygic	Edificarian-ruderal	Mainland	Upper Keys	Lower Keys
<i>Siren lacertina</i>	—	—	M	A	—	—	X	—	—
<i>Pseudobranchius s. belli</i>	—	—	M	A	—	—	X	—	—
<i>Notophthalmus v. piaropicola</i>	—	R	M	A	—	—	X	—	—
<i>Amphiuma means</i>	—	—	M	A	—	—	X	—	—
<i>Scaphiopus holbrooki</i>	A	R	—	—	—	R	X	—	X
<i>Bufo marinus</i>	—	—	—	—	—	R	X	—	—
<i>Bufo quercicus</i>	M	R	A	—	—	M	X	—	X
<i>Bufo t. terrestris</i>	A	M	M	—	—	M	X	—	X
<i>Eleutherodactylus r. planirostris</i>	M	A	—	—	—	M	X	X	X
<i>Acris g. dorsalis</i>	—	—	A	—	—	—	X	—	—
<i>Pseudacris n. verrucosa</i>	M	—	A	—	—	—	X	—	—
<i>Limnaeodius ocularis</i>	—	—	A	—	—	—	X	—	—
<i>Hyla cinerea</i>	M	M	A	—	—	—	X	X	X
<i>Hyla femoralis</i>	A	—	R	—	—	—	X	—	—
<i>Hyla gratiosa</i>	A	—	R	—	—	—	X	—	—
<i>Hyla septentrionalis</i>	—	A	—	—	—	M	X	X	X
<i>Hyla squirella</i>	M	M	A	—	—	M	X	X	X
<i>Gastrophryne carolinensis</i>	M	M	A	—	—	R	X	X	X
<i>Rana a. aesopus</i>	R	—	—	—	—	—	X	—	—
<i>Rana grylio</i>	—	—	M	A	—	—	X	—	—
<i>Rana pipiens</i>	M	—	A	M	—	—	X	—	X

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<i>Chelydra osceola</i>	—	—	M	A	—	—	X	—	—
<i>Sternotherus odoratus</i>	—	—	M	A	—	—	X	—	—
<i>Kinosternon b. bauri</i>	—	—	—	A	M	—	—	—	X
<i>Kinosternon b. palmarum</i>	—	—	M	A	—	—	X	X	—
<i>Kinosternon s. steindachneri</i>	—	—	M	A	R	—	X	—	—
<i>Terrapene c. bauri</i>	A	M	M	—	—	—	X	X	X
<i>Malaclemys t. macrospilota</i>	—	—	—	—	A	—	X	—	—
<i>Malaclemys t. rhizophorarum</i>	—	—	—	—	A	—	—	X	X
<i>Malaclemys t. tequesta</i>	—	—	—	—	A	—	X	—	—
<i>Pseudemys f. peninsularis</i>	—	—	M	A	—	—	X	—	—
<i>Pseudemys nelsoni</i>	—	—	M	A	—	—	X	—	—
<i>Deirochelys r. chrysea</i>	—	—	—	M	—	—	X	—	—
<i>Gopherus polyphemus</i>	R	—	—	—	—	—	X	—	—
<i>Trionyx ferox</i>	—	—	—	A	—	—	X	—	—
<i>Crocodylus acutus</i>	—	—	—	—	M	—	X	X	X
<i>Alligator mississippiensis</i>	—	—	M	A	M	—	X	X	X
<i>Gonatodes fuscus</i>	—	—	—	—	—	A	—	—	X
<i>Hemidactylus turcicus</i>	—	—	—	—	—	A	X	—	X
<i>Sphaerodactylus a. argus</i>	—	—	—	—	—	?	—	—	?
<i>Sphaerodactylus cinereus</i>	—	—	—	—	—	A	—	—	X
<i>Sphaerodactylus notatus</i>	M	A	—	—	—	M	X	X	X
<i>Anolis carolinensis</i>	M	A	M	—	—	M	X	X	X
<i>Anolis distichus</i>	—	A	—	—	—	M	X	—	—
<i>Anolis s. stejnegeri</i>	M	—	—	—	—	A	X	—	X
<i>Leiocephalus c. virescens</i>	—	—	—	—	—	?	?	—	—
<i>Sceloporus woodi</i>	A	—	—	—	—	—	X	—	—
<i>Ophisaurus a. longicaudus</i>	R	—	—	—	—	—	X	—	—
<i>Ophisaurus compressus</i>	A	—	M	—	—	—	X	—	—
<i>Ophisaurus ventralis</i>	A	—	M	—	—	—	X	—	—
<i>Ameiva ameiva</i>	—	M	—	—	—	—	X	—	—
<i>Cnemidophorus s. sexlineatus</i>	A	M	—	—	—	—	X	X	X
<i>Lygosoma laterale</i>	M	A	—	—	—	M	X	X	X
<i>Eumeces e. egregius</i>	A	M	—	—	—	—	—	X	X
<i>Eumeces e. onocrepis</i>	M	—	—	—	—	—	X	—	—

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	Xeric	Mesic	Alternohygic	Hygic	Halohygic	Edificarian-ruderal	Mainland	Upper Keys	Lower Keys
<i>Eumeces inexpectatus</i>	M	A	R	—	—	M	X	X	X
<i>Eumeces laticeps</i>	—	R	—	—	—	—	X	—	—
<i>Neoseps reynoldsi</i>	R	—	—	—	—	—	X	—	—
<i>Diadophis p. punctatus</i>	M	A	R	—	—	—	X	X	X
<i>Heterodon platyrhinos</i>	M	—	—	—	—	—	X	X	—
<i>Farancia a. abacura</i>	—	—	A	M	—	—	X	—	—
<i>Coluber c. paludicola</i>	—	M	A	—	—	—	X	X	—
<i>Coluber c. priapus</i>	A	M	—	—	—	—	X	—	X
<i>Masticophis f. flagellum</i>	A	—	—	—	—	—	X	—	—
<i>Opheodrys aestivus</i>	M	M	A	—	—	—	X	X	X
<i>Drymarchon c. couperi</i>	M	A	M	—	—	—	X	X	X
<i>Elaphe g. guttata</i>	A	M	R	—	—	M	X	X	X
<i>Elaphe o. quadrivittata</i>	M	A	—	—	—	—	X	X	?
<i>Elaphe o. rossalleni</i>	—	M	A	—	—	—	X	—	—
<i>Pituophis m. mugitus</i>	R	—	—	—	—	—	X	—	—
<i>Lampropeltis d. doliata</i>	A	M	—	—	—	—	X	—	?
<i>Lampropeltis g. floridana</i>	M	M	A	—	—	—	X	—	—
<i>Cemophora coccinea</i>	M	M	—	—	—	—	X	—	—
<i>Tantilla c. wagneri</i>	A	M	—	—	—	—	X	X	—
<i>Natrix c. floridana</i>	—	—	M	A	—	—	X	—	—
<i>Natrix s. compressicauda</i>	—	—	—	—	A	—	X	X	X
<i>Natrix s. pictiventris</i>	—	—	M	A	—	—	X	—	—
<i>Natrix taxipilota</i>	—	—	R	M	—	—	X	—	—
<i>Seminatrix p. cyclas</i>	—	—	M	—	—	—	X	—	—
<i>Storeria d. victa</i>	A	M	M	—	—	—	X	—	X
<i>Thamnophis s. sackeni</i>	M	R	A	—	—	—	X	—	X
<i>Thamnophis s. sirtalis</i>	M	R	M	—	—	—	X	—	—
<i>Liodytes alleni</i>	—	—	A	—	—	—	X	—	—
<i>Micrurus f. fulvius</i>	M	A	—	—	—	—	X	X	—
<i>Agkistrodon p. piscivorus</i>	—	—	M	A	M	—	X	X	X
<i>Sistrurus m. barbouri</i>	R	—	A	—	—	—	X	—	—
<i>Crotalus adamanteus</i>	A	R	—	—	—	—	X	X	X

A, abundant; M, moderately abundant; R, apparently rare; X, present; ?, presence not established, or if formerly present now apparently extinct.

study and on the work of others than on the data derived from our studies in southern Florida.

Since in its broader aspects vegetation is a manifestation of the combined effects of climate, substrate, and topography, all of which in large measure determine animal distributions, it naturally follows that a high degree of coincidence between faunal and floral boundaries is to be expected. An analysis of the herpetofauna bears out this supposition. It is true that in some instances, aquatic turtles for example, this correlation may break down. In table 1 the distribution of the amphibians and reptiles of southern Florida is given for the five major natural habitats plus "edificarian and ruderal." Furthermore, notation is made as to the apparent abundance of the individual species in each habitat.

The principal division of habitats is between the xeric (pine forests and scrub) and the althernohygric (prairies and cypress flats). Twenty-two species occur in the xeric habitats but not in the althernohygric ones; these include:

Scaphiopus holbrooki	Lygosoma laterale
Eleutherodactylus ricordi	Eumeces egregius
Hyla femoralis	Neoseps reynoldsi
Hyla gratiosa	Heterodon platyrhinos
Rana areolata	Masticophis flagellum
Gopherus polyphemus	Pituophis melanoleucus
Sphaerodactylus notatus	Lampropeltis doliaata
Anolis sagrei	Cemophora coccinea
Sceloporus woodi	Tantilla coronata
Ophisaurus attenuatus	Micrurus fulvius
Cnemidophorus sexlineatus	Crotalus adamanteus

Although *Hyla femoralis* and *Hyla gratiosa* have been found in cypress flats, their principal distribution appears to be in the pine forests and scrub habitats; thus, they are included in the list. Of the above species, *Gopherus polyphemus*, *Sceloporus woodi*, and *Neoseps reynoldsi* appear to be restricted, at least in southern Florida, to the rosemary-scrub habitat. On the other hand, *Masticophis flagellum* and *Pituophis melanoleucus* have been found only in pine forests in southern Florida. *Heterodon platyrhinos* has been encountered in pine forest and in scrub. *Anolis sagrei* most commonly inhabits edificarian situations, but where it occurs in natural situations, it is found in xeric pine forest. The other 11 species are found in xeric habitats and mesic hammocks.

Twenty-one species inhabit the wet pariries, cypress flats, and aquatic situations in these environments, but do not range into the pine forests, scrub, or hammocks. This group includes:

<i>Siren lacertina</i>	<i>Pseudemys floridana</i>
<i>Pseudobranchius striatus</i>	<i>Pseudemys nelsoni</i>
<i>Notophthalmus viridescens</i>	<i>Alligator mississippiensis</i>
<i>Amphiuma means</i>	<i>Farancia abacura</i>
<i>Acris gryllus</i>	<i>Natrix cyclopion</i>
<i>Limnaoedus ocularis</i>	<i>Natrix sipedon</i>
<i>Rana grylio</i>	<i>Natrix taxispilota</i>
<i>Chelydra osceola</i>	<i>Seminatrix pygaea</i>
<i>Sternotherus odoratus</i>	<i>Liodytes alleni</i>
<i>Kinosternon bauri</i>	<i>Agkistrodon piscivorus</i>
<i>Kinosternon subrubrum</i>	

Of these, *Acris gryllus*, *Limnaoedus ocularis*, *Farancia abacura*, *Liodytes alleni*, and *Agkistrodon piscivorus* are inhabitants of the prairies and flats, but do not display essentially aquatic habits. *Pseudobranchius striatus*, *Notophthalmus viridescens*, small *Siren* and *Amphiuma*, and *Seminatrix pygaea* live in the masses of aquatic vegetation, but not in open water. The other species are more or less aquatic. Eggs of *Notophthalmus viridescens* have been found in hammocks, but so far as is known the adults inhabit only the aquatic situations in the prairies and cypress ponds. Other common inhabitants of the prairies, but not restricted to this habitat include:

<i>Bufo quercicus</i>	<i>Elaphe obsoleta</i>
<i>Hyla cinerea</i>	<i>Lampropeltis getulus</i>
<i>Hyla squirella</i>	<i>Thamnophis sauritus</i>
<i>Rana pipiens</i>	<i>Sistrurus miliaris</i>
<i>Coluber constrictor</i>	

Although 34 species have been encountered in one or more kinds of hammocks in southern Florida, and 11 species appear to reach their greatest abundance in this mesic habitat, it is doubtful if any are restricted to this environment. *Eumeces laticeps*, a little-known species in southern Florida, has been collected only in oak hammock. *Hyla septentrionalis* and *Anolis distichus*, both introduced species that occur in edificarian situations, are most abundant in mesic habitats. Eleven species occur in pine forests and in hammocks, but not in the prairies. Eighteen species are common to all three habitats, namely:

<i>Bufo quercicus</i>	<i>Coluber constrictor</i>
<i>Bufo terrestris</i>	<i>Ophiodrys aestivus</i>
<i>Hyla cinerea</i>	<i>Drymarchon corais</i>
<i>Hyla squirella</i>	<i>Elaphe guttata</i>
<i>Gastrophryne carolinensis</i>	<i>Elaphe obsoleta</i>
<i>Terrapene carolina</i>	<i>Lampropeltis getulus</i>
<i>Anolis carolinensis</i>	<i>Storeria dekayi</i>
<i>Eumeces inexpectatus</i>	<i>Thamnophis sauritus</i>
<i>Diadophis punctatus</i>	<i>Thamnophis sirtalis</i>

The above species are among the most abundant and widespread amphibians and reptiles in southern Florida; of these, only *Anolis carolinensis*, *Eumeces inexpectatus*, *Diadophis punctatus*, and *Drymarchon corais* appear to reach their greatest abundance in the mesic habitats.

Seven species are known to occur in the pine forests or rosemary scrub and in the wet prairies or cypress flats, but not in the mesic hammocks; these are:

Pseudacris nigrita
Hyla femoralis
Hyla gratiosa
Rana pipiens

Ophisaurus compressus
Ophisaurus ventralis
Sistrurus miliarius

As stated previously, *Hyla femoralis* and *Hyla gratiosa* are essentially restricted to the pine and scrub habitats; they enter the cypress area where pine and cypress mix and interdigitate in central Collier County. *Sistrurus* and *Rana pipiens*, for the most part, are inhabitants of the prairies, but where prairie and pine habitats meet they are often encountered in the pine woods. Both species of *Ophisaurus* are most frequently encountered in grassy areas, whether these be in the pine savannas or in the prairies. *Pseudacris nigrita* appears to be associated with the surface-pitted limestone, a condition that appears frequently in the prairies and in the pine woods. This species is particularly abundant in the pine-prairie ecotone in Dade County.

The aquatic turtles *Deirochelys* and *Trionyx*, although inhabiting permanent water in the Everglades and associated habitats, apparently do not range into the real prairies. *Crocodylus*, the three forms of *Malaclemys terrapin*, and *Natrix sipedon compressicauda*, together with the 5 species of sea turtles, are confined to salt- or brackish-water habitats. *Kinosternon bauri*, *Alligator mississippiensis*, and *Agkistrodon piscivorus* are frequently found in salt or brackish water.

Restricted to edificarian situations are 3 species of lizards, all of which have the earmarks of rather recent introductions—*Gonotodes fuscus*, *Hemidactylus turcicus*, and *Sphaerodactylus cinereus*. Other introduced forms along with certain native species are found in greater or lesser abundance in the edificarian-ruderal habitat.

From the above analysis it is clear that although none of the major habitats has a highly restricted herpetofauna, each has characteristic species. Forty-five species inhabit the xeric habitats, and 7 of these are confined to that habitat; 34 inhabit the mesic, and 1 is confined; 46 inhabit the alternohygic, and 4 are confined; 21 inhabit fresh water, and 2 are confined; 7 inhabit brackish water, and 3 are

confined (sea turtles not included); 18 inhabit edificarian-ruderal situations, and 3 are confined. Not included are *Ameiva ameiva* and *Bufo marinus*, both recently introduced species, and *Leiocephalus carinatus* and *Sphaerodactylus argus*, both of which were introduced into edificarian habitats but apparently did not survive.

In three different instances two races of a species inhabit different environments in southern Florida. *Coluber constrictor paludicola* ranges throughout the prairie habitats and sometimes enters the mesic hammocks; *C. c. priapus* inhabits the pine forests, scrub, and hammocks. *Elaphe obsoleta* has a similar distribution, with the race *quadrivittata* being found in the pine forests and hammocks, whereas the race *rossalleni* is essentially confined to the prairies. In *Natrix sipedon*, the subspecies *pictiventris* inhabits freshwater ponds and streams, the prairie, and cypress flats; the subspecies *compressicauda* is restricted to the brackish mangrove swamps and salt marshes.

GEOGRAPHY OF THE HERPETOFAUNA

In order to gain an adequate understanding of the amphibians and reptiles of southern Florida as a fauna, we must examine not only the distribution of the species in the major habitats, but in the distinct geographical areas as well. A knowledge of the former helps to clarify the latter. Essentially southern Florida can be divided into two geographical areas, the mainland and the Florida Keys.

The geographical distribution of the herpetofauna on the mainland is a direct reflection of the ecological distribution of the component species. The southern part of the peninsula consists of relatively high land along the coasts supporting xeric and some mesic habitats, and a low interior basin with wet and mesic habitats. Species restricted to the dry environments are found only in the eastern and western coastal regions; those that are restricted to the wet habitats are found only in the interior region. The geographical distribution of a given species may be ascertained by examining figure 3 and the locality records for that species in the "Accounts of the species." Exclusive of the sea turtles, there are 80 species (87 species and subspecies) of amphibians and reptiles in southern Florida. With the exception of 3 species of introduced lizards and 3 native subspecies, all occur on the mainland (see table 2).

The other principal geographical area, the Florida Keys, by nature of its geological history and present vegetation, may be subdivided into the upper keys (Key Largo to Bahia Honda Key inclusive) and the lower keys (from Bahia Honda to Key West). The upper keys are

a coral reef formation supporting luxuriant tropical hammocks. The lower keys have been formed from Miami oölite, the same formation making up the eastern rim of the peninsula, and support a dry pine-palmetto association. Twenty-one species of amphibians and reptiles are definitely reported from the keys, not including introduced species. Those species inhabiting the mainland and the upper and lower keys are:

<i>Hyla cinerea</i>	<i>Eumeces egregius</i>
<i>Hyla squirella</i>	<i>Eumeces inexpectatus</i>
<i>Gastrophryne carolinensis</i>	<i>Diadophis p. punctatus</i>
<i>Kinosternon bauri</i>	<i>Coluber constrictor</i>
<i>Terrapene carolina bauri</i>	<i>Ophiodrys aestivus</i>
<i>Malaclemys terrapin</i>	<i>Drymarchon corais couperi</i>
<i>Crocodylus acutus</i>	<i>Elaphe g. guttata</i>
<i>Alligator mississippiensis</i>	<i>Natrix sipedon compressicauda</i>
<i>Anolis carolinensis</i>	<i>Agkistrodon piscivorus</i>
<i>Cnemidophorus s. sexlineatus</i>	<i>Crotalus adamanteus</i>
<i>Lygosoma laterale</i>	

Of these, *Kinosternon bauri*, *Malaclemys terrapin*, *Crocodylus acutus*, *Alligator mississippiensis*, *Natrix sipedon compressicauda*, and *Agkistrodon piscivorus* are either restricted to salt- and brackish-water habitats or occur in these habitats so frequently that dispersal in Florida Bay and the keys would be accomplished with little difficulty.

Three species are known from the mainland and the upper keys, but not from the lower keys; these are *Heterodon platyrhinos*, *Tantilla coronata wagneri*, and *Micrurus f. fulvius*. Both *Tantilla* and *Micrurus* are frequent inhabitants of hammocks, a dominant habitat on the upper keys; *Heterodon* is usually found in pine woods or open sandy areas on the mainland; the latter is a restricted habitat on the upper keys. Six species occur on the mainland and the lower keys, but not on the upper keys; these include: *Scaphiopus holbrooki*, *Bufo quercicus*, *Bufo t. terrestris*, *Rana pipiens*, *Storeria dekayi victa*, and *Thamnophis sauritus sackeni*. With the exception of *Rana pipiens*, all of the above species are commonly found in pine woods on the mainland; this habitat is widespread on the lower keys.

In some species different races inhabit the keys and the mainland. *Eumeces e. egregius* occurs on the lower keys and the upper keys; *E. e. onocrepis* is found on the mainland. *Coluber constrictor priapus* inhabits the lower keys and the mainland north of the Everglades, whereas the subspecies *paludicola* lives in the Everglades and the upper keys. *Kinosternon b. bauri* is found on the lower keys, the subspecies *palmarum* on the upper keys and mainland. *Malaclemys*

terrapin rhizophorarum may be restricted to the keys; other subspecies occur on the mainland. In most species there are no striking differences between the populations on the mainland and on the keys; however, in some, interesting variation has been noted. The population of *Bufo terrestris* on Big Pine Key consists of toads that are noticeably smaller than ones from the mainland; the individuals from the keys have a greenish color compared to the brown of the mainland toads. Continuous clinal variation from northern Florida onto the keys is apparent in *Gastrophryne carolinensis*, *Elaphe guttata*, and *Micrurus f. fulvius*. In five species occurring on the lower keys the range of variation in certain characters approximates more closely that found in samples from northern Florida than that from samples from the southern part of the peninsula. In *Lygosoma laterale* and *Eumeces egregius* the populations in northern Florida and on the keys resemble one another in color pattern. This is also true in *Coleler constrictor*. Furthermore, in the last species and in *Diadophis punctatus* and *Storeria dekayi victa*, the same pattern of geographical variation is displayed in certain aspects of the scutellation. Possible explanations of these patterns of variation and the present geographical distributions are offered in the following section.

ORIGIN OF THE HERPETOFAUNA⁵

With a knowledge of the present geographical and ecological distributions of the species of amphibians and reptiles in southern Florida, together with the data presented on the trends in variation, certain speculations concerning the origin of the herpetofauna may be made. The questions that may be raised are: What are the relationships of the fauna? By what dispersal routes did the species enter southern Florida and the Florida Keys? How were the present patterns of distribution formed? And, what has been the cause of differentiation in certain members of the fauna? Needless to say, none of these questions can be definitely answered. In some instances where sufficient evidence is available, more than one logical explanation is usable; in others, the picture is so complex and the evidence so scanty, that little in the way of an explanation can be offered. We should like to emphasize that, although in most instances we have

⁵ While this paper was in press Coleman J. Goin (1958, Comments upon the origin of the herpetofauna of Florida. Quar. Jour. Florida Acad. Sci. vol. 21, no. 1, pp. 61-70) presented a discussion of the origin of the present Floridian herpetofauna on an historical basis. The conclusions he draws are in accord with those presented here.

substantial bases for the following opinions, these ideas are, for the most part, purely speculative.

Of the 68 native species of amphibians and reptiles known to occur in southern Florida, 59 are more or less widely distributed in the Atlantic coastal plain of the southeastern United States; of these, many have broad geographical ranges in eastern North America. Eight species (*Pseudobranchius striatus*, *Kinosternon bauri*, *Pseudemys nelsoni*, *Sceloporus woodi*, *Eumeces egregius*, *Neoseps reynoldsi*, *Seminatrix pygaea*, and *Liodytes alleni*) are restricted to, or center in, peninsular Florida. *Crocodylus acutus* occurs in Middle America and the West Indies, as well as southern Florida. Of the introduced forms, all but *Bufo marinus* and *Ameiva ameiva* (both recent introductions through human agencies) are widely distributed in the West Indies. Those introduced species that have more or less broad ranges or that have undergone differentiation in southern Florida (*Eleutherodactylus ricordi*, *Hyla septentrionalis*, *Sphaerodactylus notatus*, and *Anolis sagrei*) may have reached southern Florida from Cuba or the Bahamas by rafting or some other natural means. The other introduced species have their ranges in southern Florida restricted to port cities and evidently are recent introductions by man. There is no biological or geological evidence that a land bridge ever existed between the Florida peninsula or the keys and any of the islands in the West Indies. Thus, with the exception of the introduced species and possibly *Crocodylus*, the herpetofauna of southern Florida has been derived directly from that of North America, more specifically from that of the southeastern Atlantic coastal plain. Of course, many species inhabiting the southeastern Atlantic coastal plain were derived from or are related to species or groups of species living in the southwestern United States or Middle America. Thus, *Micrurus fulvius*, *Drymarchon corais*, and *Crocodylus acutus* are examples of species having wide ranges in Middle America. Others belong to genera which apparently underwent their major differentiation in Mexico or the southwestern United States and represent forms that entered the southeastern Atlantic coastal plain and subsequently peninsular Florida. Included in this group are such species as *Rhadinaea flavilata*, *Crotalus adamanteus*, *Lygosoma laterale*, and *Cnemidophorus sexlineatus*. These entered the southeastern Atlantic coastal plain from the west along the Gulf coastal plain. Evidence for this highway of dispersal is discussed by Neill (1957) and Auffenberg (1958).

Six genera are endemic or nearly endemic to the Florida peninsula, namely: *Pseudobranchius*, *Rhineura*, *Neoseps*, *Stilosoma*, *Semi-*

natrix, and *Liodytes*. Of these *Pseudobranchius* and *Seminatrix* have invaded the Atlantic coastal plain as far north as South Carolina, and *Liodytes* as far north as southern Georgia. Of the endemic forms only *Stilosoma* and *Rhineura* do not occur in the southern part of the peninsula.

To understand the origin and present distributions of these species, some knowledge of the historical geology of the peninsula is essential. Most geologists agree that land has persisted in central Florida in the form of a peninsula or group of islands since Pliocene time and that with the fluctuation in sea level during the Pleistocene this land was alternately a peninsula (sometimes more extensive than the present one) and an archipelago. Hubbell (1954) has presented paleogeographic maps of the Florida peninsula for the Pleistocene. How much land was emergent in southern Florida, if any, is not known. There is biological evidence in support of the theory that the east coast ridge, the lower keys, and parts of what is now Florida Bay were above sea level, at least as a chain of islands, during the last part of the Pleistocene. Since the region that is now central Florida was alternately connected with and separated from continental North America during the Pleistocene and probably during the Pliocene, the Florida endemics could have been isolated in that area and differentiated from their parent stocks, or, some of the endemics may be relict populations of once widespread species that are now extinct elsewhere. Among those that may have arisen through isolation in this manner are: *Pseudobranchius* from an early sirenid stock, *Kinosternon bauri* from an early *subrubrum* stock, *Pseudemys nelsoni* from an early *rubriventris* stock, and *Sceloporus woodi* from an early *undulatus* stock. The other endemic species have no close allies living in the southern or eastern United States; these relict forms include *Rhineura floridana*, *Eumeces egregius*, *Neoseps reynoldsi*, *Stilosoma extenuatum*, *Seminatrix pygaea*, and *Liodytes alleni*. After the connection of the islands with the continent, most of these species remained in the area of central Florida; some followed sandy habitats or marshes southward, and *Pseudobranchius*, *Seminatrix*, *Eumeces* and *Liodytes* moved northward to invade the Atlantic coastal plain.

Until late in the Pleistocene, most or possibly all of southern Florida and the Florida Keys was submerged. With the emergence of this land came the development of soils followed by plant and animal immigrants from the north. With the spread of *Pinus caribaea* and *Serenoa repens* came members of the pineland herpetofauna. Probably the area that is now the Everglades was part of a large body of water, of which only Lake Okeechobee remains. With the deposi-

tion of muck soils filling in the shallow basin, the prairie flora developed; then from the north immigrated the members of the prairie herpetofauna. This seems to be a simple and logical manner of populating the newly emerged southern part of the peninsula with animals from the older land mass to the north. It is in regard to populating the Florida Keys that difficulties arise. The upper keys have an impoverished fauna derived from the southern mainland; all of the species could have dispersed through the chain of islands by rafting or other fortuitous means. Likewise, the depauperate fauna of the lower keys was derived from the mainland. However, 6 native species occur on the lower keys and on the mainland, but not on the upper keys. There are certain ecological differences between the upper and lower keys. First, the upper keys have a predominantly mesic vegetation consisting of hammocks; the vegetation of the lower keys is a pine-palmetto association, the same that is present over large areas of the southern mainland. Second, the lower keys and the eastern rim of the peninsula are made up of the same geological formation, the Miami oolite, whereas the upper keys are the remains of a coral reef built up on the seaward side of the Miami oolite. Third, the edaphic conditions, apparently controlled by the underlying rock, are essentially the same on the lower keys and the eastern rim of the mainland, but different on the upper keys. Therefore, it appears that because of the differences in geology, different soils and consequently different vegetations have developed on the upper and lower keys.

In southern Florida the *Pinus caribaea-Serenoa repens* association which is widespread in the southern part of the peninsula and on the lower keys apparently is a fire disclimax. In areas where fires have been controlled for a number of years mesic hammock has invaded the pine forests. Climatic succession possibly has permitted mesic hammock to replace pine forest on the upper keys, but not on the lower keys. Although the soils of the lower keys and eastern mainland are the same, the temperatures of the lower keys are higher and the rainfall less than on the mainland. This may account for the absence of mesic hammocks on the lower keys.

In attempting to solve the biogeographic relationships of the lower keys the evidence provided by investigations of the historical geology of the southern part of the mainland and the keys must be taken into consideration. As stated earlier there is biological and geological support for the contention that there was a connection between the lower keys and the eastern mainland that did not involve the upper keys. Storm (1945) and Price (1954) have provided

geological evidence, and Neill (1957) and Auffenberg (1958) biological evidence for a connection between the lower keys and the western mainland across Florida Bay. The Gulf coast of Florida, including the area that is now Florida Bay is a submergent coast. Geological evidence points to the fact that there has been an east-west tilt in peninsular Florida, resulting in a sinking of the western shoreline. Florida Bay is a broad shallow expanse of water separating the lower keys, and the upper keys as well, from the southwestern mainland. Only a slight amount of sinking is required to submerge the entire area.

On the basis of our knowledge of the present and past geography of the peninsula and the keys and of the environments of the areas under consideration the following possible explanations of the differences in the herpetofauna of the upper and lower keys may be offered:

1. Fortuitous rafting has brought more species from the mainland to the lower keys than to the upper keys.
2. Climatic succession has caused mesic hammocks to replace pine forests on the upper keys, but not on the lower keys, resulting in the extinction of certain species on the upper keys, but permitting their survival on the lower keys.
3. Before the upper keys (the coral reef) emerged from the sea, there was a land connection across Florida Bay from the mainland to the lower keys, thus permitting continuous animal populations throughout the area. Later the area that is now Florida Bay submerged, isolating populations on the lower keys. Finally the coral reef emerged to form the upper keys; this chain of islands was populated by a secondary invasion from the mainland.
4. Before the upper keys emerged, the east coast rim was emergent and continuous from the mainland through the lower keys. There were continuous animal populations throughout the area. Later the region of the present upper keys submerged (possibly correlated with the sinking of the western shoreline), isolating populations on the lower keys. Finally the coral reef emerged to form the upper keys, which were populated by a secondary invasion from the mainland.

Several salient features must be discussed with regard to the above possibilities. Although there is a relatively short waterway from the southern tip of the peninsula (Cape Sable region) to the lower keys, it is unlikely that any of the species occurring on the

lower keys reached those islands by rafting from the tip of the peninsula. The southern part of the peninsula jutting into Florida Bay supports one of the largest mangrove swamps in the world. The species living on the lower keys, but not on the upper ones, are inhabitants of dry pine-palmetto environments and do not occur in the mangrove swamps. Rafting from north to south along the Atlantic coast of the peninsula to the lower keys is not likely, because the Gulf Stream flows northward in this area.

If climatic succession of mesic hammock over pine forest has occurred on the upper keys, species of reptiles and amphibians inhabiting pine forest but not mesic hammock would have been eliminated from the upper keys. This would result in isolated populations of certain species on the lower keys; however, it does not explain why there are differences between populations on the upper and lower keys and often similarities between those on the mainland and the lower keys. Nevertheless, if such succession did occur (and there is no evidence to the contrary), this may account for some of the differences between the herpetofauna of the upper and lower keys.

As stated previously, several species inhabiting the lower keys have coloration, proportions, or scutellation more like populations of those species in northern Florida than like those in southern Florida or on the upper keys, if they occur at all on the latter. Such population differences occur in enough species so as to make this factor just as important as the presence and absence of species in determining the method by which the lower keys were populated. To explain these differences we must turn to the geological history of the area. The major clue provided by the geological evidence is that sometime in the late Pleistocene, probably in pre-Pamlico time (Wisconsin) a continuous land mass extended from the region of east-central Florida to the southwestern tip of the Florida Keys. Furthermore, this probably was continuous across Florida Bay to the Gulf coast of the peninsula, which at that time was west of the present shoreline. With the rise in sea level this land mass was fragmented into an archipelago, and the southern part of the peninsula, with the possible exception of the eastern rim, and Florida Bay were submerged together with the area that is now the upper keys. This resulted in the complete isolation of the lower keys from the mainland. In all probability the eastern rim and lower keys composed of Miami oolite were higher with respect to present sea level than they are now. This limestone formation has formed a typical karst topography, showing all of the signs of considerable solution and sinking, resulting in continuous lowering of the land to its present

level. In post-Wisconsin time the coral reef rose to form the upper keys and to provide an insular connection between the mainland and the lower keys.

How did these geological events affect the distribution and differentiation of members of the herpetofauna? In pre-Pamlico time continuous populations extended from northern Florida southward throughout the area of the Florida Keys. With the rise in sea level and submergence of large areas of land, populations of many species were isolated in the area that is now the lower keys. Here some species differentiated slightly from the parental stocks to the north on the mainland; others apparently remained unchanged. With the establishment of an insular connection between the mainland and the lower keys, species moved southward from the peninsula and onto the upper keys; some continued onto the lower keys where they encountered members of previously isolated populations. Clinal variation in many species shows continuous gradual differences from north to south in the peninsula and often onto the upper keys followed by an abrupt change on the lower keys, the animals on the lower keys being more like those in the northern part of the peninsula than in the southern part or on the upper keys. Some species did not immigrate to the upper keys; some of these were species that had ranged southward to the area of the lower keys in pre-Pamlico time. This has resulted in the isolated populations of such species as *Scaphiopus holbrooki*, *Bufo quercicus*, *Bufo terrestris*, and *Storeria dekayi* on the lower keys.

We feel that it is safe to assume that the areas comprising the eastern rim, the keys, and the western flatlands were emergent and supporting vegetation and most of the species of the present herpetofauna before the southern part of the Okeechobee basin filled with sediments and formed the Everglades and associated prairies and savannas. The herpetofauna of the Everglades is similar to that of the drier Kissimmee prairies to the north of Lake Okeechobee and probably was derived from the fauna of that area. Some of the most striking differentiation in the herpetofauna of southern Florida centers in the Everglades. Here are found the apparently ecogenotypic populations of blue-gray *Coluber constrictor*, the orange-colored *Elaphe obsoleta*, the pale *Lampropeltis getulus*, and the pale *Kinosternon bauri*, together with other species showing differences in size and proportions. Most of these species are inhabitants of the eastern rim as well as the Everglades. Usually populations on the rim north and east of the Everglades and on the lower keys are similar to one

another, but different from those inhabiting the Everglades. On the southern part of the rim and on the upper keys are found populations with intermediate characteristics. Because of the lack of barriers to most species, there is gene flow between populations in the Everglades and the older, undifferentiated populations on the rim. This results in populations from the Everglades interdigitating with those from the rim, populations showing intermediate characteristics, or a complex mosaic of populations having recombinations of characteristics or even new characteristics.

Because the Everglades serve as a barrier to many inhabitants of the pine forest and scrub habitats, there is some isolation of these populations in southern Florida. Populations of *Hyla femoralis*, *Hyla gratiosa*, *Sceloporus woodi*, and *Gopherus polyphemus* in the scrub habitats near Naples, although not geographically remote, are widely separated in terms of gene flow from those populations in northeastern Dade County; the scrub habitats are absent from the interior of the peninsula south of Lake Okeechobee. Some minor differences are found between the populations to the west and those to the east of the Everglades. These are discussed specifically in the accounts of the individual species.

ACCOUNTS OF THE SPECIES

In the following pages the 92 forms of amphibians and reptiles known to occur in southern Florida are discussed in relation to their variation and differentiation in that area, their life histories, and their ecological and geographical distributions in the southern part of the Florida peninsula and the keys. The accounts of geographical distribution are based on 8755 museum specimens from southern Florida. Of these, data pertaining to variation and differentiation are presented for 3116 specimens. Comparative material examined from northern Florida and from other parts of the Atlantic coastal plain, and from various Caribbean islands consists of 2657 specimens.

Locality records for each form are given at the end of the account. Mileages are road distances, and directions are road directions, unless otherwise indicated. Thus, the Tamiami Trail extends due west from Miami; 19 miles west of Miami a road leaves the Tamiami Trail and extends south. A specimen collected 5 miles south of this road junction is listed as: *Dade County*: 19 mi. W, 5 mi. S of Miami. Museum catalogue numbers have been used only when reference is made to a particular specimen in the text; the abbreviations used for the museums are:

AMNH	American Museum of Natural History
ANSP	Academy of Natural Sciences of Philadelphia
CAS	Chicago Academy of Sciences
ChM	Charleston Museum
CM	Carnegie Museum
CNHM	Chicago Natural History Museum
CU	Cornell University
DRP	Dennis R. Paulson, Miami, Florida
ERA-WTN	E. Ross Allen-Wilfred T. Neill, Silver Springs, Florida
MCZ	Museum of Comparative Zoology
SU	Natural History Museum, Stanford University
UF	University of Florida Collections
UI	University of Illinois Museum of Natural History
UMMZ	University of Michigan Museum of Zoology
UMRC	University of Miami Reference Collection
USNM	United States National Museum

Means of counts and measurements are in parentheses after the observed range, for example, 91-112 (104). Capitalized color names are from Ridgeway (1912). Unless otherwise indicated by the presence of a synonymy, all names are in accordance with the sixth edition of the "Check list of North American amphibians and reptiles" by Schmidt (1953). Literature references in the synonymies which are not complete are contained in the "Literature cited."

Siren lacertina Linnaeus

In life the coloration is grayish above; the ventral surface is irregularly mottled or spotted with pale green. These colors fade rapidly in preserved material, and the color shortly becomes a dull uniform gray. The largest individual from southern Florida, a female, has a snout-vent length of 452 mm. and a total length of 611 mm. Most specimens are of a much smaller size, and very large adults rarely have been taken in southern Florida. The ratio of total length to tail length in 38 specimens varies from 2.6 to 3.8 (3.0). The number of costal grooves varies from 33 to 40 (37.0). Data from seven specimens from northern Florida and 31 from South Carolina show that in those from South Carolina the ratio varies from 3.0 to 3.7 (3.2), and the number of costal grooves ranges from 36 to 39 (37.4). In the specimens from northern Florida the total length to tail ratio varies from 2.7 to 4.2 (3.0), and the number of costal grooves varies from 38 to 40 (38.6). Goin (1942: 217) pointed out that the number of costal grooves is of primary importance in distinguishing *S. lacertina* from *S. intermedia*. He stated that *S. lacertina* has on the average 38 costal grooves, while *intermedia* varies from 31 to 38. The data presented here show that populations of *S. lacertina* have costal grooves

varying in number from 33 to 40, a range generally overlapping that of *intermedia*; however, the coloration of the two species allows for easy identification of fresh specimens. *S. intermedia* has not been taken in southern Florida.

Neill (1949a) described and differentiated between the juveniles of *S. lacertina* and *intermedia*, basing his conclusions on specimens collected near Midville, Burke County, Georgia. The young of both species were collected together in a shallow flatwood pond; Neill stated that *S. intermedia* normally breeds and lives in such ponds, and that the young of *S. lacertina* probably had been washed into the pond by a freshet from a nearby river. Neill stated that juvenile *S. intermedia* possess a bright red band across the snout that extends irregularly almost to the gills; the rest of the animal is grayish-brown above and below. The illustration of this juvenile shows the tail fin pigmented (except for a narrow band on the tail itself) and extending anteriorly on the body for about one quarter of the snout-vent length. On the other hand, juveniles of *S. lacertina* are characterized by a light yellowish stripe on the side from the base of the gills to about the level of the vent; a less distinct yellowish ventrolateral line also is present. The caudal fin, which extends far anteriorly on the body, is described as clear yellowish white. There is an irregular brownish line from the eye to the base of the gills.

Comparison of 20 juveniles from southern Florida with the above descriptions indicates that they resemble Neill's *S. lacertina* in some ways, but disagree in others. The tail fin is heavily pigmented with dark brown; it is not clear and does not extend anteriorly as described, but terminates immediately anterior to the vent. There are no lateral or ventrolateral yellowish stripes as described by Neill, nor were such stripes present in the living specimens. Usually there is a faint postocular stripe, and the labial area is pale brown. The top of the head has a few scattered dark spots on a gray ground color. These juveniles vary in snout-vent length from 33 to 49 mm. The possibility that these juveniles represent *S. intermedia* has not been overlooked. Their designation as *S. lacertina* is based on the fact that they lack (now and when collected) any red markings as described by Neill for *S. intermedia*, and that they were taken at the same locality where adult *S. lacertina* were secured. It would seem that if these juveniles represent *S. intermedia*, the adults of the species also would have been encountered. Such is not the case. It is possible that juvenile sirens may vary in details of color pattern at different localities, and thus result in the discrepancies noted.

The majority of specimens of *S. lacertina* were secured by netting and sieving water hyacinths in the Tamiami Canal at a period of low water. The adults were taken in deep water (2½ to 3 feet), whereas juveniles occurred principally in a shallow (6 to 12 inches) mucky-bottomed pond. One was observed in water beneath a piece of limestone. During periods of very high water, for example 1947, the Tamiami Trail was locally flooded and sirens were observed to cross the road. Individuals were taken from tunnels in canal banks. These tunnels, which slant downward at about 45 degrees and then level off, were 14 to 19 inches long and 1¼ to 2½ inches in diameter. At the end of each tunnel was a chamber about 6 inches in diameter in which the animal rested and where it was usually captured. The tunnel openings were about a foot below the water surface. During periods of high water *Siren* are difficult to secure since at that time the salamanders occupy whatever water is available and are not restricted to sloughs and canals as in periods of dryness. That sirens occupy temporary water is shown by the collection of specimens in a temporary shallow pond in Broward County. They are presumed to gain access to such ponds by tunneling through the mucky substrate.

The stomachs of 9 specimens have been examined to determine food habits. These stomachs contained the following: 1 crane-fly (Tipulidae), 6 rat-tailed maggots (Stratiomyidae), 4 water beetles (Hydrophilidae), 2 scarabid beetles, 4 nymphs (Odonata: Aeschnidae and Libellulidae), 1 mayfly nymph (Ephemeraeidae), 2 crayfish (Astacidae), and 1 fish (*Gambusia holbrooki*). This last food item indicates that at least occasionally *Siren lacertina* does eat fish, contrary to the opinion expressed by Goin (1957: 41).

The Everglades is the principal habitat for sirens, and the species has been taken frequently from the canals in this region. No specimens are at hand from cypress ponds, although it is likely that the siren occurs there. This salamander is absent from the keys. Locality records for 97 specimens are:

Dade County: Everglades near Miami (1), 20.1 mi. W Miami (29), 20.6 mi. W Miami (1), 21 mi. W Miami (22), 23.1 mi. W Miami (42), Tamiami Trail bridge no. 42 (1). *Monroe County*: Pinecrest (1).

Pseudobranchius striatus belli Schwartz

Pseudobranchius striatus belli Schwartz, 1952a, p. 1.

Eighteen large individuals vary in total length from 107 to 153 mm. There are 29 to 33 (31.5) costal grooves. A detailed description

of coloration and a comparison with other forms is to be found in Schwartz (1952a).

The only individuals of this species collected in the area under consideration were taken from side canals south of the Tamiami Trail during times when these canals were temporarily cut off from the main canal and when the water in them was relatively low. The majority of specimens was secured by sieving decaying masses of water hyacinths and examining the debris. What the "normal" habitat of these salamanders is can be only conjectured. Neill (1951b) commented on the habitat preferred by *P. s. lustricolus* in the Gulf Hammock region. Here, where the water hyacinth has not been introduced, the salamanders inhabit the muddy bottoms of pools. Presumably *Pseudobranchius* occupy a similar niche in southern Florida, but they may be more readily secured where they occur in dead hyacinths.

The food of *Pseudobranchius s. belli* consists of aquatic oligochaetes. Of 12 topotypes examined, 4 contained worms of the family Lumbriculidae, while 8 others contained worms of the family Megascolecidae (*Sparganophilus*). The type of food eaten indicates that foraging takes place among the roots of the water hyacinths.

This species is known only from a few localities in Dade County. It is presumed to occur throughout the Everglades; however, its aquatic habits and the general inaccessibility of the area make specimens difficult to secure. In northern and central Florida other forms of *Pseudobranchius striatus* have been collected in a variety of aquatic habitats, even in isolated cypress ponds. It should be looked for in such situations near Naples, Collier County. Flooding undoubtedly aids in the dispersal of the species. Locality records for 83 specimens are:

Dade County: Lemon City (1), 20.1 mi. W Miami (1), 23.1 mi. W Miami (81).

Notophthalmus viridescens piaropicola Schwartz and Duellman

Diemictylus viridescens piaropicola Schwartz and Duellman, 1952, p. 219.

Diemictylus viridescens evergladensis Peterson, 1952, *Herpetologica*, vol. 8, pt. 3, p. 103.

Notophthalmus viridescens piaropicola, Smith, 1953, *Herpetologica*, vol. 9, pt. 2, p. 98.

Adults range in total length from 79.0 to 104.0 mm. and from 37.2 to 55.9 mm. in snout-vent length; females average slightly larger (91.5 mm. total length, 43.5 mm. snout-vent length) than do males (88.3 mm. total length, 41.4 mm. snout-vent length). The dorsum

is dark (Fuscous-Black) in life and after preservation, and the Buff-Yellow belly, strongly mottled with black, is noteworthy. This subspecies, which ranges throughout the Florida peninsula from Citrus County southward, is compared with others in Schwartz and Duellman (1952).

The type series of *N. v. piaropicola* was taken by dipping the submerged masses of *Utricularia foliosa*, *Naiis flexuosa*, and *Hydrotrida caroliniana* from a drying cypress pool. Large numbers of these newts also were secured by dipping water hyacinths—both dead and alive—from canals; specimens also were obtained in isolated ponds, away from the main body of the Everglades. Schwartz and Duellman (p. 226) mention the taking of specimens beneath the lodges of *Neofiber alleni*; occasional specimens have been taken from beneath partially imbedded pieces of oölitic limestone along the Tamiami Trail.

At the time of the description of *N. v. piaropicola*, no eft from southern Florida were known. Examination of material in the United State National Museum indicates that a specimen there (85329) is an eft. It was taken by M. K. Brady at Pinecrest, Monroe County, 14 February 1932; it has a total length of 45 mm. and a snout-vent length of 21 mm. The skin of the dorsum is highly granular, light brown in color, and is spotted with brown like the venter, although less so. The tail is terete, and gills are absent. Neotenic individuals have been pointed out by Schwartz and Duellman (p. 225); these are similar in color and pattern to the adults.

Females taken in the spring and early summer may have eggs, and this indicates that egg deposition probably occurs at least during this period. However, it is likely that there is a more extensive breeding season. Small larvae (USNM 85330-85346) were taken 21 January 1932, in potholes which contained *Isnardia*; this winter date tends to confirm a lengthy reproductive season.

The stomach contents of 19 topotypes were examined. The most abundant material was newt skin (13 individuals, 59% of bulk). Decapod crustaceans (cf. Atylidae) occurred in 8 stomachs and formed 31.3 percent of the bulk. Amphipods, Diptera (Tanypodinae, Chironominae), Odonata (Anisoptera), and Gastropoda (*Gyraulus*) also were eaten. Thirteen specimens from another locality also were examined; all contained algaelike material, and two specimens contained fragments of insects (Coleoptera: Hydrophilidae and Dytiscidae).

Notophthalmus has been taken from canals and sloughs along the Tamiami Trail and in the Everglades. Individuals may be abundant

in cypress ponds and willow-bordered ponds at the margins of the Everglades. The species is presumed to occur throughout southern Florida with the possible exception of both eastern and western pinelands, where it may occur locally in mesic situations. Locality records for 905 specimens are:

Collier County: 2.3 mi. W Collier-Dade Co. line on Tamiami Trail (5), 5.2 mi. E Monroe Station (81). *Dade County*: 3.5 mi. SE Collier-Dade Co. line on Tamiami Trail (7), Loop Road (2), 19 mi. W Miami (5), 20.1 mi. W Miami (413), 20.6 mi. W Miami (26), 21.2 mi. W Miami (47), 22 mi. W Miami (38), 23.1 mi. W Miami (176), 24.9 mi. W Miami (5), 26 mi. W Miami (53), Paradise Key (13), 1.3 mi. N, 5.2 mi. NE of Paradise Key (6). *Monroe County*: Flamingo (1), 60 mi. W Miami (5), 5.4 mi. S Monroe Station (20), Pincrest (2).

Amphiuma means Garden

Amphiuma means Garden, 1821, in Smith, Correspondence of Linnaeus. vol. 1, pp. 333, 599. Hill, 1954, Tulane Studies Biol., vol. 1, no. 12, pp. 191-215. *Amphiuma means means*, Goin, 1938, Herpetologica, vol. 5, pp. 127-130.

In 49 specimens from Dade County the number of costal grooves varies from 51 to 61 (57.6); the vomerine teeth vary from 25 to 46 (33.3). In total length the largest individual measured 625 mm., and the smallest 93 mm.; the three largest males measured 385, 399, and 404 mm., and the three largest females measured 391, 470, and 625 mm. The color of both young and adult individuals after preservation is black dorsally, grading to Deep Neutral Gray ventrally. Neither in life nor after preservation can these specimens be called Mummy Brown, as stated by Bishop (1943: 53). The belly color of some immature specimens is lighter (Deep Mouse Gray). The dorsal and ventral colors gradually merge into each other and there is no clear line of demarcation between them. The upper and lower jaws are black, and the fleshy flanges on the lower jaw are grayish.

The ratio of total length to body length in 55 southern Florida specimens varies from 1.2 to 1.4 (1.32). This may be compared to the ratio in six specimens from South Carolina in which the range of variation is from 1.2 to 1.3 (1.27); three specimens from Alachua County, Florida have a mean ratio of 1.30. The ratio of length of tail to total length in 55 specimens from southern Florida varies from 19.7 to 28.2 (24.7), in six specimens from South Carolina from 19.3 to 23.8 (21.6), and in three specimens from Alachua County, Florida from 23.6 to 26.4 (25.1). Specimens from South Carolina have 31 to 44 (38.4) vomerine teeth; a somewhat higher average number than that found in southern Florida. Obviously, additional ma-

terial is needed from the northern part of the range before adequate assessment of the data can be made. The impression is, however, that at least the length of the tail varies clinally, the individuals with shorter tails being in the northern part of the range.

Amphiuma is strictly aquatic and consequently is restricted to permanent standing water, or water with a low flow gradient. As far as known, this salamander does not occur in rivers in southern Florida, and it is absent from water which may be under saline influence during yearly fluctuation. Most southern Florida specimens have been secured by removing water hyacinths from canals and sloughs and examining the roots thereof. In this manner *Amphiuma* has been taken with *Pseudobranchius*, *Siren*, and *Notophthalmus*. However, at the type locality of the last, a cypress pond, no *Amphiuma* were secured.

These salamanders form a major part of the diet of *Farancia abacura*; on two occasions this large snake has been seen in a violent struggle with a large salamander, presumably *Amphiuma*, but possibly *Siren*.

Examination of eleven stomachs of *Amphiuma* yielded the following results: Two were empty; three contained mucus and plant fragments. The other six stomachs contained 4 rat-tailed maggots (Syrphidae), 2 naiads (Libellulidae), 5 aquatic beetles (Dytiscidae and Hydrophilidae). Two individuals had eaten crayfish, and one stomach contained only the remains of a fish (*Mollienesia latipinna*). A specimen kept in captivity was fed *Fundulus*, *Chryopeops*, and *Jordanella*, and was seen to eat the eggs directly from the swimmerets of a crayfish, and later to eat the crayfish itself. Hamilton (1950) examined the stomachs of *Amphiuma* from Ft. Myers, Florida, and North Charleston, South Carolina; he found that in a combined sample of 36 specimens the food taken included insects (52.8% in frequency and 33.8% in bulk) as the most important item, and that the salamanders also ate amphibians, reptiles, fish, crustaceans, mollusks, and arachnids.

Weber (1944) reported on a female *Amphiuma* and her eggs. The nest was discovered on 3 February 1933 at a locality 25 miles south of Royal Palm Hammock (now Paradise Key), Dade County. The female (390 mm. in length) was found under a board imbedded in muck, and was coiled around 49 eggs. The eggs were in a rosary-like string. A second set of eggs was received by Weber on 10 February 1935, and these were hatched on 21 June 1935. Assuming that the eggs are deposited in mid-January, the incubation period

is estimated to be about five months. It is presumed that the finding of a female *Amphiuma* with her eggs represents a fortuitous occurrence in which the object under which the female burrows to lay the eggs is exposed by fluctuations in water level. Since the respiration in these forms is primarily pulmonary, such exposed nesting sites are able to remain inhabited as long as they remain moist and do not become overheated. In this regard, Weber stated that the board under which the brooding female was taken "was covered with the dry and caked marsh scum and decayed vegetation. This covering apparently acted as an insulator against the baking action of the sun and conserved moisture for the eggs." Baker (1945: 64), in discussing these egg-laying activities, stated that "burrowing into the mud bank" would better express the terrestrial activities of *Amphiuma* than "crawling onto land."

Amphiuma probably is distributed over the central part of southern Florida, in the Everglades region. There are no records from the east coast ridge (where suitable habitat is limited), nor from the keys, where it certainly does not occur. In the western region it probably occurs in canals and cypress ponds, but specimens and records are lacking. Locality records for 69 specimens are:

Dade County: Coral Gables (1), 4.2 mi. S Florida City (2), Miami (2), 20.1 mi. W Miami (35), 23.1 mi. W Miami (23), Paradise Key (1), 25 mi. SW Paradise Key (1), Tamiami Trail bridge no. 42 (2), *Monroe County*: Pinecrest (2).

Scaphiopus holbrooki Harlan

Rana holbrookii Harlan, 1835, Medical Physical Research, p. 105.

Scaphiopus albus Garman, 1877, Proc. Amer. Assoc. Adv. Sci., vol. 25, p. 194.

Scaphiopus holbrookii albus, Carr, 1940, p. 53.

Scaphiopus holbrooki, Duellman, 1955a, p. 143.

Adult males vary in snout-vent length from 45 to 64 mm.; females are slightly smaller, ranging from 43 to 63 mm. Specimens from Key West, formerly considered to be a different subspecies, are smaller than those from the mainland, the males averaging 51.7 mm. in snout-vent length as compared to 59.2 mm. for the males from the Miami area. Typical individuals from the mainland have a light tan or grayish dorsal ground color with three more or less distinct dark brown or olive-brown longitudinal bands. Many individuals from the lower keys are lighter in color. The variation in this species with respect to the Florida populations has been discussed at length by Duellman (1955a: 141-3). Aside from the slight variation in the intensity of the dorsal pigmentation, the only observable trend is in

the over-all size of the individuals, there appearing to be a trend toward smaller size from north to south in the Atlantic coastal plain, peninsular Florida, and the Florida Keys.

Scaphiopus occurs in the sandy regions on the eastern rim of southern Florida, being found in the palmetto scrub and pineland. Specimens also have been found at Paradise Key, Dade County, a locality presenting in general more mesic conditions than the eastern rim. The abundance of the spadefoot may be easily underestimated, for nothing short of torrential rains will bring them from their underground retreats. For this reason many residents refer to them as the "hurricane frog." Their abundance in vacant lots, on lawns, and in the streets of cities after a heavy rain is surprising. Carr (1940: 53) stated that in Key West the species was most abundant in vacant lots on the south edge of the island.

Individuals have been found in their burrows, which are nearly one and one-half inches in diameter and at least eight inches in length. Spadefoots were observed emerging from such burrows during a heavy rain in Miami.

On three different occasions when there has been rainfall in excess of three inches within a twelve-hour period, large breeding choruses have been encountered. Two of the choruses were in the northwestern part of Miami on 5 and 27 October 1952. The other was encountered near Surfside, Dade County, on 27 June 1953. The following notes concern the chorus of 5 October 1952. *Scaphiopus* were seen in an open marshy field that was flooded in many places due to a very heavy rain. At 2:30 P.M. many individuals were seen, but none was calling. Within an hour after the first males began calling, the chorus of an estimated 2000 individuals put forth an ear-splitting racket. As the rain continued to fall, the spadefoots increased in numbers. In the largest pond, which extended for nearly a mile and was approximately 300 feet wide, there were at least four individuals per 100 square feet, giving an estimated total of more than 60,000 spadefoots in this large pond. In the same area *Scaphiopus* were calling from every pool of water, including small holes in the road and even from a flower pot! There were several other large choruses in the vicinity, and there are reliable reports that the species was calling in many other places in Miami. The following night only a few scattered individuals were calling.

The males call from the open water and float with their legs outstretched. When the vocal sac is inflated the forepart of the body is reared upward at an angle of about 75 degrees and the legs are

forced backward. The call is a nasal "waank" coming about once every two seconds. These calls are repeated from 6 to 15 times, after which there is a period of silence for about 20 seconds. Males were observed to clasp other males, which caused the defendant to spin in a circular motion and call rapidly until the offender released him. A male *Scaphiopus* was found in amplexus with a female *Bufo terrestris*.

Many small females were observed in the congregation, but individuals measuring less than 43 mm. in snout-vent length were not gravid. The eggs are laid in an elongated mass that is almost string-like in appearance; these are attached to sticks and weeds six to eight inches below the surface of the water. There are no further data available concerning the breeding habits of this form in southern Florida. The length of time required from hatching to metamorphosis is not known, although it probably coincides with that given by Wright and Wright (1949: 126) who give the minimum time as 14 days. A series of 63 recently transformed young from Princeton, Dade County, average slightly more than 13 mm. in body length.

Food taken from the stomachs indicates that the diet consists mainly of terrestrial arthropods, including beetles, ants, grasshoppers, Dermaptera, and spiders. One terrestrial gastropod was found. One specimen collected in the chorus described above regurgitated an *Acris gryllus*, and another, a *Bufo quercicus*.

In southern Florida *Scaphiopus* is found only in the eastern part of the peninsula and on the lower keys. Wright and Wright (1949: 129) report this species from Matecumbe Key; however, since there are no specimens from that locality, the record is open to question. Locality records for 412 specimens are:

Broward County: Dania (1). *Dade County*: Biscayne Gardens (1), Coral Gables (1), Little River (1), Miami (204), 12 mi. W, 2.1 mi. S Miami (1), 19 mi. W, 9.5 mi. S Miami (1), Miami Beach (5), Paradise Key (21), Princeton (63), South Miami (1), Surfside (23). *Monroe County*: Key West (89).

Bufo marinus Linnaeus

Rana marina Linnaeus, 1758, Systema Naturae, ed. 10, vol. 1, p. 211.

This species has been introduced into the Miami area and apparently has become established. L. Neil Bell (*in litt.* to Roger Conant) stated: "I observed mated pairs, tadpoles, and about 11 calling males at one little pond. They were calling elsewhere in the general vicinity." Dennis R. Paulson stated (*in litt.*) that in the summer of 1957

the population was thriving. One specimen collected by Bell (UMMZ 113000) has the following data: western part of Miami, Dade County, 17 May 1955. The specimen is a male with a snout-vent length of 140 mm.

Several years ago *Bufo marinus* was introduced into the sugar cane fields near Pennsuco, which is about 10 miles northwest of Miami. Possibly the present population was derived from that introduction which supposedly died out. More likely, however, the present population has resulted from either accidental or intentional release of captive specimens by animal dealers in the Miami area. The single locality record is cited above.

Bufo quercicus Holbrook

A series of 20 males from Miami average 26.5 mm. in snout-vent length; six females average 27.9 mm. From the small number of adult specimens available from Big Pine Key, it appears as though the individuals on the keys are somewhat smaller than those on the mainland; both sexes average 24.2 mm. in snout-vent length on Big Pine Key. The largest specimen examined, a female, has a snout-vent length of 30 mm.; the smallest juvenile measured 14 mm. The dorsal ground color is a light tan. The dorsal markings are dark brown, and the flanks are mottled with dark brown and cream. The middorsal light line is golden yellow or orange. The venter usually is clear cream color, although in some the ventrolateral areas are grayish, and in a few specimens the belly is mottled with black. The specimens from the keys are generally darker with a thinner and more dull-colored middorsal line (fig. 20).

Specimens from southern Florida were compared with series from Silver Springs, Marion County, Florida, and from Charleston, South Carolina. The Charleston specimens are slightly darker than the Florida ones, the middorsal line being dull in color and the venter dusky. The specimens from Silver Springs are essentially the same as those from southern Florida.

This species is characteristic of the rocky and sandy pineland and is commonly found in areas of sandy scrub. It also occurs in hammocks and in the wet prairies, but it reaches its greatest abundance in the pineland. It is often encountered during the day. Individuals were found to be active at midday in the sandy scrub areas on Marco Island. Scattered males have been heard calling during the day. Choruses have been heard from mid-April to late October, and presumably breeding takes place between those dates. The breeding

choruses usually are found in small pools and shallow ditches, the toads never being found in deep water. The males, more often than not, call from small clumps of vegetation at the edge of the water, although amplexus takes place in the water. The call is a shrill chicklike "peep."

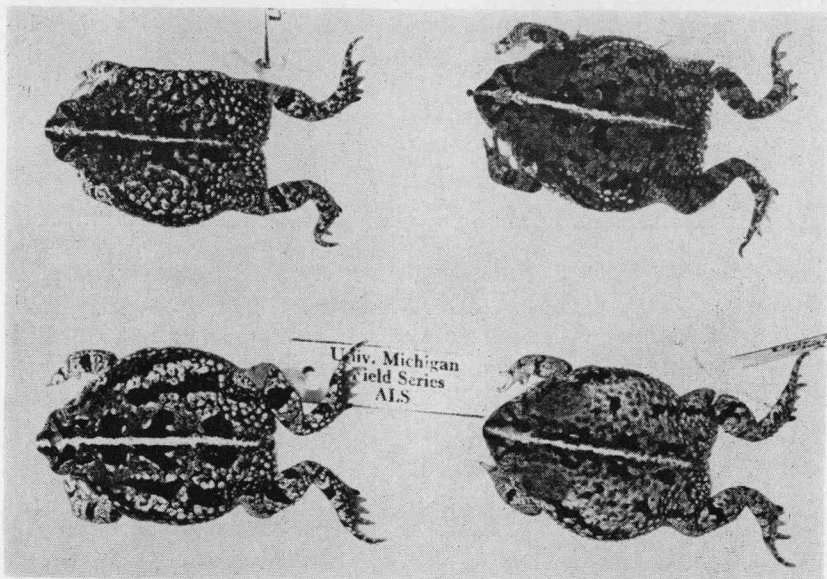


Figure 20.—Variation in the dorsal color pattern in *Bufo quercicus* from Miami.

Examination of the stomach contents of 15 individuals collected in Miami revealed that ants were the most abundant food item and made up about half of the diet. Other food items found include several beetles, 3 lepidopteran larvae, 1 hemipteran, and 2 spiders.

Bufo quercicus probably constitutes the greatest part of the diet of small *Heterodon*. *Thamnophis sauritus* also have been seen feeding on this toad.

In southern Florida *Bufo quercicus* is abundantly found on the east coast rim and the Gulf coastal region as far south as Marco Island. Less frequently it is encountered in the Everglades. It is also known from Big Pine Key and Boca Chica Key; presumably it occurs on all of the lower keys. Locality records for 439 specimens are:

Broward County: 1 mi. W Davie (17), 1.6 mi. W Hollywood (1), 2.2 mi. W Hollywood (1). *Collier County*: Marco Island (12), Naples (4), 1.7 mi. SE Naples

(1), 3 mi. SE Naples (10), 3.2 mi. SE Naples (1), 5 mi. SE Naples (1), 6.7 mi. SE Naples (28), 7.4 mi. SE Naples (3), 10 mi. SE Naples (1). *Dade County*: Coral Gables (2), 1.5 mi. SE Florida City (16), Homestead (2), 4 mi. S Homestead (14), 6 mi. S Homestead (1), Long Pine Key (4), Miami (122), 7 mi. W, 2.5 mi. N Miami (9), 8 mi. W, 3 mi. N Miami (26), 12 mi. W, 1 mi. N Miami (40), 17.5 mi. W Miami (15), Miami Beach (1), Miami Springs (11), Opa-locka (16), Paradise Key (2), Richmond Air Base (44), Uleta (7). *Monroe County*: Big Pine Key (26), Boca Chica Key (1).

Bufo terrestris terrestris Bonnaterre

Apparently *Bufo terrestris* reaches its maximum known size in southern Florida. The largest male examined had a snout-vent length of 67 mm.; the largest female, 107 mm. Wright and Wright (1949: 201) gave 92 mm. as the maximum size for this toad. That the above female is not an exceptional giant is shown by two other specimens having snout-vent lengths of 104 and 106 mm. The smallest juvenile is from Big Pine Key; it has a snout-vent length of 9.5 mm. A series of 11 juveniles from Snake Bight, Monroe County, range in size from 10.0 to 12.7 (10.8) mm. Of the specimens known from the keys, the largest is a female measuring 70 mm. in snout-vent length. There is a slight size difference in specimens from the Everglades as compared with those from the eastern rim; individuals from the lower keys are notably smaller than those from the mainland (table 3).

TABLE 3

GEOGRAPHICAL VARIATION IN *Bufo t. terrestris* IN SOUTHERN FLORIDA.
(MEASUREMENTS IN MILLIMETERS.)

Locality	Sex	N	Body length	Tibia length	Tibia length	Head width	Head width
					Body length		Body length
Coral Gables	♂	18	58.8	22.5	38.3%	23.3	39.6%
	♀	13	67.0	23.7	35.4	26.9	40.1
Everglades	♂	11	58.7	21.0	35.8	22.0	37.5
	♀	12	65.1	22.0	33.8	24.7	37.9
Big Pine Key	♂	5	48.8	14.4	35.7	18.1	37.0
	♀	24	51.3	18.2	35.5	20.3	39.7

Specimens from the mainland have a light grayish-brown or yellowish-brown dorsal ground color. The dorsal blotches are dark brown or olive brown, and in a few individuals they are greenish. In many instances the blotches are large and numerous, with only thin streaks of the light ground color between them. The venter is a clear cream color except for the throat of the males, which is black. Individuals from Big Pine Key had in life, a ground color of light

gray, but dark gray in some and tannish in a few. The dorsal dark spots were of varying shades of olive green. The parotoid gland was reddish brown to greenish gray.

Bufo terrestris occurs in the sandy and rocky pinelands, the sandy scrub, mesophytic hammock, and a variety of edificarian and ruderal situations. Although found in the wet prairies, it is not nearly so abundant there as it is in the more xeric habitats.

This species is more nocturnal than *Bufo quercicus*; however, during and just after daytime showers it is possible to see these toads moving about. On three different occasions during the summer of 1951 male *Bufo terrestris* called from a pond on the University of Miami campus in Coral Gables following afternoon showers. Early on a clear morning after a hard rain during the night, this species was heard calling in a flooded field near Cutler, Dade County. *B. terrestris* breeds in nearly any situation where water is available; they have been found chorusing in flooded fields, roadside ditches, sink holes, permanent ponds, canals, sloughs, and even puddles. This species prefers deeper water than *B. quercicus*, and where the two species are breeding in the same body of water, *B. terrestris* is found calling and mating toward the middle of the pond, while *B. quercicus* stays in the shallow water at the periphery. The breeding season begins with the first heavy spring rains in April and continues through August; a few individuals have been heard as late as 27 October. Their high-pitched trill is often heard on warm summer nights when there has been no rain.

Recently metamorphosed individuals have been found from mid-June to early October. On Snake Bight, a narrow spit of sandy marl surrounded by mangroves and jutting into Florida Bay east of Cape Sable, scores of juvenile *Bufo terrestris* were found on the afternoon of 21 June 1953. The lack of fresh water in the vicinity at that time poses the question: What is the tolerance of *Bufo* eggs and tadpoles to the brackish water in the mangrove swamps?

Several large adults were collected at night under street lights in the town of Everglades, Collier County. The toads were feeding on the insects that hit the lights and fell to the ground. At the base of each lamp post was a six- by eight-inch opening. Several toads were seen entering and emerging from these holes, a probable daytime retreat for these city dwellers. An examination of the stomach contents of these toads revealed that about 95 percent of the bulk of the food consisted of beetles of the families Carabidae, Cicindelidae, and Curculionidae. Other food items included one grasshopper

(Tetrigidae), one wasp (Sphecidae), several ants (Formicidae), two Hemiptera, one Dermaptera, and one small gastropod.

Food items found in the stomachs of ten specimens from Miami include many beetles (Carabidae, Curculionidae, Elateridae, and Scarabaeidae), several ants (Formicidae), two Dermaptera, and one isopod. The beetles accounted for more than 90 percent of the bulk, and curculionids alone made up about 50 percent of the bulk.

With the exception of the upper keys, *Bufo terrestris* is found throughout southern Florida. It is most abundant on the eastern rim, but is found commonly in the Everglades. Locality records for 450 specimens are:

Broward County: Dania (1), Ft. Lauderdale (7), 16 mi. WNW, 6.2 mi. S Ft. Lauderdale (1), 1 mi. E, 1 mi. N Hallandale (1), Hollywood (1), 1.6 mi. W Hollywood (3), 2.2 mi. W Hollywood (3). *Collier County*: 5 mi. S Deep Lake (4), Everglades (64), Marco Island (3), 4 mi. W Monroe Station (1), 4.3 mi. E Ochopee (12), Naples (3), 3 mi. SE Naples (1), 6.7 mi. SE Naples (1), 9 mi. SE Naples (1), Royal Palm Hammock (7), 4.5 mi. SE Royal Palm Hammock (3). *Dade County*: Coconut Grove (1), Coral Gables (84), Cutler (20), 2 mi. E Florida City (8), 2.2 mi. W Florida City (1), 4.1 mi. W Florida City (1), Homestead (2), 2 mi. S Kendall (1), Lee Hammock (1), 3 mi. NW Medley (1), Miami (55), 7 mi. W, 2.5 mi. N Miami (9), 10 mi. W Miami (1), 17.5 mi. W Miami (25), Miami Beach (24), 2 mi. NW Miami Springs (1), Paradise Key (11), 5.4 mi. SW Paradise Key (1), 10 mi. SW Paradise Key (1), 11 mi. SW Paradise Key (3), 20 mi. N Paradise Key (1), Richmond Air Base (6), South Miami (4), 2 mi. W South Miami (1). *Monroe County*: Big Pine Key (31), Cudjoe Key (2), Pinecrest (1), Snake Bight (11), Sugar Loaf Key (25).

Eleutherodactylus ricordii planirostris Cope

Twenty males from the vicinity of Miami have snout-vent lengths from 15.0 to 17.5 (16.6) mm.; 20 females vary from 19.5 to 25.0 (22.6) mm. The largest specimen examined, a female from Cudjoe Key, has a snout-vent length of 26.5 mm. Three hatchlings collected in Miami on 25 June 1953, vary in snout-vent length from 5.5 to 6.0 (5.8) mm. The percentage of individuals with striped and mottled color patterns has been determined (table 4). The number of specimens now available more than doubles the number used by Goin for determining color pattern variation in southern Florida specimens. However, the ratio of striped to mottled individuals is close to that given by him (1947: 30). The populations on the keys have the highest frequency of striped individuals; on the upper keys the ratio approximates 1:1.

Essentially terrestrial in its habits, *Eleutherodactylus* occurs abundantly in the mesophytic hammocks of the eastern rim of the mainland and upper keys. On the lower keys it is found in humid

sites and in edificarian situations. Calling males have been heard on warm rainy nights throughout the summer months. No eggs of this species were found.

TABLE 4

FREQUENCIES OF DORSAL COLOR PATTERNS IN *Eleutherodactylus ricordi planirostris* FROM SOUTHERN FLORIDA.

Area	Striped	Mottled	Total
Miami	23 (28.4%)	58 (71.6%)	81
Upper keys	15 (44.1%)	19 (55.9%)	34
Lower keys	39 (40.6%)	57 (59.4%)	96

Stomach contents included largely ants (Formicidae), small beetles, spiders, and a copepod.

Eleutherodactylus is known in southern Florida from the eastern rim of the mainland and throughout the chain of Florida Keys. The record given below for Cape Sable is questionable. Locality records for 312 specimens are:

Broward County: Birch State Park (1), Ft. Lauderdale (4), Hollywood (6). *Dade County*: Biscayne Bay (1), Coconut Grove (3), Coral Gables (41), Elliot Key (6), Hialeah (2), Homestead (2), 2 mi. E Homestead (1), Lemon City (4), Matheson Hammock (45), Miami (34), 7 mi. W, 2.5 mi. N Miami (1), Paradise Key (5), 20 mi. N Paradise Key (1). *Monroe County*: Big Pine Key (18), Cape Sable (1), Cudjoe Key (6), Islamorada, Upper Matecumbe Key (1), Key Largo (21), Key West (76), Little Torch Key (2), Stock Island (24), Sugarloaf Key (4), Summerland Key (2).

Acris gryllus dorsalis Harlan

Females are slightly larger than males; 21 females have snout-vent lengths varying from 18.7 to 23.9 (20.2) mm., and 10 males from 15.9 to 20.3 (18.2) mm. Apparently, this race attains a larger size in southern Florida than it does in the northern part of the peninsula, for Netting and Goin (1945: 304) remark that females of *dorsalis* seldom exceeded 20 mm.

There is considerable variation in color pattern. Often the dorsal ground color is green with dark olive-green to brown bars on the dorsolateral surfaces of the body; usually the middorsal light stripe is well defined. However, some individuals are so darkly colored as virtually to obscure the dark bars and leave no trace of the middorsal stripe. The diagnostic thigh pattern described by Netting and Goin is constant in specimens from southern Florida.

Acris is found in nearly all aquatic habitats in southern Florida except salt marshes. It has been detected calling from canals and

sloughs in the Everglades, cypress ponds, temporary pools in pine-lands, artificial ponds, and brackish-water marshes. Singing males are first heard in mid-March; actual choruses are formed by April and continue until middle or late October, reaching a peak in May and June. Recently transformed young have been collected in July and August.

The food items contained in stomachs of 36 individuals include: Orthoptera, Gryllidae (1); Coleoptera, Carabidae (1), Dytiscidae (many), Hydrophilidae (many), Pselaphidae (1), Scarabaeidae (1), Staphylinidae (1); Hemiptera, Corixidae (1); Hymenoptera, Formicidae (many); Diptera, Ichneumonidae (2). Aside from the above insects one lycosid spider was found. Beetles comprised the greatest percentage of bulk, followed by ants.

Acris has been removed from the stomachs of *Scaphiopus*, *Natrix sipedon pictiventris*, and *Thamnophis sauritus*.

In southern Florida *Acris* occurs everywhere on the mainland where there is fresh water; it reaches its greatest abundance in the wet prairies and cypress ponds. It does not occur on the keys. The type specimen of *Acris acheta* Baird, of unknown provenance, was stated to have originated from Key West. This we believe to be in error. Locality records for 80 specimens are:

Dade County: Coral Gables (1), Homestead (2), 4 mi. S Homestead (2), 9 mi. N, 6.6 mi. W Homestead (1), Miami (1), Paradise Key (3), 15.9 mi. SW Paradise Key (2). *Collier County*: 8.2 mi. W Monroe Station (15), Naples (11), 3 mi. SE Naples (2), 4.2 mi. SE Naples (2), 5 mi. SE Naples (2), 7.7 mi. SE Naples (1), 4.6 mi. NW Royal Palm Hammock (12), 1.6 mi. NW Royal Palm Hammock (3). *Monroe County*: 6.1 mi. S, 6.4 mi. E of Monroe Station (2), Pinecrest (18).

Pseudacris nigrita verrucosa Cope

A series of twenty males from the eastern edge of the Everglades in Dade County displays the following variation in measurements: snout-vent length 24.9-28.7 (26.7) mm., tibia length 12.2-13.6 (12.9) mm., head width 7.6-8.4 (8.0) mm.; six females display the following variation: snout-vent length 26.8-29.8 (28.2) mm., tibia length 13.5-13.9 (13.8) mm., head width 7.8-8.8 (8.4) mm. The dorsal color pattern, consisting of dark olive-green to brownish-black spots on a green or greenish-tan ground color, is variable in the relative amount of the dorsum covered by the spots. In some individuals the squarish spots are large and close together so that the ground color is represented solely by narrow lines between the spots; the other extreme has a few scattered dark spots on the dorsum, thus leaving large areas of ground color.

Pseudacris has been reported as breeding from mid-January to early September in southern Florida. It appears to reach its peak in June and July. The males call from the bases of, or in the midst of clumps of, grasses, from the ground, or from holes and cracks in the limestone borders of sink holes. Brady and Harper (1935: 109) reported a clutch of 160 eggs deposited by a recently collected female.

Examination of the stomach contents of ten individuals revealed the remains of ants and small beetles.

Wherever *Pseudacris* has been found in southern Florida it has been associated with limestone sink holes, especially bordering the wet prairies. In the rather narrow rocky pineland-Everglades ecotone between Miami and Homestead the species is especially abundant. Similar ecological conditions are associated with its presence in the vicinity of Naples, Collier County. It does not occur in sandy country, in the wet prairies proper, nor on the keys. Locality records for 92 specimens are:

Collier County: 2.1 mi. N Deep Lake (1), 1 mi. E Naples (5), 3.1 mi. SE Naples (1). *Dade County*: 4.3 mi. W Florida City (2), 9 mi. N, 2 mi. W Homestead (40), 9 mi. N, 7 mi. W Homestead (11), Miami (1), 19 mi. W, 6.4 mi. S Miami (7), 19 mi. W, 8 mi. S Miami (13), Paradise Key (6), 1.3 mi. N, 5.2 mi. E Paradise Key (5).

Limnaoedus ocularis Daudin

Hyla ocularis Daudin, 1801, in Sonnini and Latreille, *Histoire Naturelle Reptiles*, vol. 2, p. 187.

Hylodes ocularis Holbrook, 1838, *North American Herpetology*, ed. 1, vol. 3, p. 79, pl. 14.

Limnaoedus ocularis, Mittleman and List, 1953, *Copeia*, no. 2, p. 83.

Twenty males have snout-vent lengths from 13.0 to 15.5 (14.2) mm. and tibia lengths from 7.0 to 9.0 (7.7) mm.; four females have snout-vent lengths from 15.3 to 16.0 (15.6) mm. and tibia lengths from 7.8 to 8.1 (8.0) mm. There is little variation in coloration; the dorsal ground color may be light yellowish tan, greenish gray, or light reddish brown, with or without a darker middorsal longitudinal stripe.

Limnaoedus is abundant in the wet prairies, where breeding choruses can be detected throughout the summer. Calling males cling to sawgrass, needle grass, or cattails and perch above the water, sometimes at a height of three or more feet. Claspings pairs have been found on plants above the water.

The contents of ten stomachs were examined; only the remains of small ants, a small spider, and a small unidentified crustacean were found.

This small species apparently ranges throughout the prairie regions of southern Florida; in areas where there is an interdigitation of prairie and pineland it is found in the pineland. A specimen of this species is included in a small collection made for the Academy of Natural Sciences of Philadelphia by Mr. Hebard and is purported to be from Key West. Several forms in Hebard's collection from Key West are unknown from the island. On the basis of the questionable provenance of the specimens and because of the lack of appropriate habitat for *Limnaeodus* on Key West, we do not consider the record to be valid. Locality records for 64 specimens are:

Broward County: 18.8 mi. WNW Ft. Lauderdale (13). *Collier County*: 2.1 mi. N Deep Lake (1), 3 mi. SE Naples (1), 4.6 mi. NW Royal Palm Hammock (1), 5.2 mi. NW Royal Palm Hammock (1). *Dade County*: Homestead (2), 9 mi. N, 7 mi. W Homestead (5), 7 mi. W, 2.5 mi. N Miami (18), 19 mi. W Miami (2), 6.5 mi. SW Paradise Key (13). *Monroe County*: 8.2 mi. W Monroe Station (7).

Hyla cinerea Schneider

Calamita cinereus Schneider, 1799, *Historiae Amphibiörum*, vol. 1, p. 174.
Hyla semifasciata Hallowell, 1856, *Proc. Acad. Nat. Sci. Philadelphia*, vol. 8, p. 307.
Hyla evittata Miller, 1899, *Proc. Biol. Soc. Washington*, vol. 13, p. 75.
Hyla cinerea evittata, Dunn., 1937, p. 10.

Twenty males from the vicinity of Miami display a variation in snout-vent length from 40.2 to 50.7 (45.6) mm., three females, 50.0 to 57.5 (53.5) mm. Individuals on the keys and the eastern rim are larger than those in the Everglades; specimens from the keys more closely approach those from northern Florida in size (table 5).

The finding of several specimens that had incomplete or no lateral light stripes prompted an investigation of the frequency of occurrence of these color pattern variations in other parts of the range with special attention to the validity of the subspecies *evittata*. Those individuals in which the light stripe continues posterior to the sacrum are considered as having a complete stripe; those in which the stripe terminates between the insertion of the forelimb and the sacrum are categorized as having a half stripe. The remaining individuals either have no stripe at all or a thin light line along the upper lip; in these the stripe is considered to be absent. Four hundred and sixty-six specimens from the southern United States were examined (table 6). None of the samples was made up of individuals with only one kind of color pattern, and all samples contained some individuals with half stripes. The populations with the highest frequencies of the three kinds of color pattern are: complete stripes—Gainesville, Florida, 85 percent; half stripes—Melville, Louisiana, 70

TABLE 5

GEOGRAPHICAL VARIATION IN MEAN MEASUREMENTS AND PROPORTIONS OF
Hyla cinerea IN PENINSULAR FLORIDA.

Locality	N	Body length	Tibia length	Tibia length	Head width	Head width
				Body length		Body length
Silver Springs, Marion County	10	50.6	25.5	50.4%	14.7	29.1%
Miami, Dade County	20	45.6	22.8	50.0	13.0	28.5
Ochopee, Collier County	20	38.4	18.9	49.2	10.6	27.6
Cudjoe Key, Monroe County	12	48.0	23.3	48.5	14.4	30.0

TABLE 6

FREQUENCIES OF STRIPED COLOR PATTERN IN *Hyla cinerea* FROM
SOUTHERN UNITED STATES.

Locality	Complete	Lateral Stripe Incomplete	Absent	Total
Florida				
Big Pine Key	0	2	3	5
Cudjoe Key	4	6	3	13
Englewood	18	2	1	21
Gainesville	22	4	0	26
Miami	54	11	4	69
Ochopee	53	4	12	69
Silver Springs	17	11	3	31
Georgia				
Okefenokee Swamp	5	3	1	9
South Carolina				
Charleston	24	8	2	34
Virginia				
Jamestown	12	3	3	18
Louisiana				
Alexandria	4	1	1	6
Holden	7	2	0	9
Melville	9	36	6	51
Texas				
Liberty County	7	11	3	21
Rockport	16	30	35	81
Illinois				
Wolf Lake	1	1	1	3
TOTAL	253	135	78	466

percent; no stripes—Big Pine Key, Florida, 60 percent. The Big Pine Key sample is small (5 specimens); however, of 81 individuals from Rockport, Texas, 43 percent lacked stripes, and 37 percent had half stripes.

Dunn (1937) in discussing color pattern variation in *Hyla cinerea* in the northeastern part of its range stated: "81% in the upper tide-water Potomac area have no stripe or a short stripe; 41% in other parts of Maryland and Virginia have no stripe or a short one. Carolina material available to me is not very extensive, but it would seem that there only 25% have no stripe or a short stripe, whereas 75% have a long stripe. Reports from further south indicate that 100% long stripe occurs in the far south, especially on the Gulf Coast." The acquisition of large series from the far south provides evidence contradicting Dunn's statement about the frogs in that region. Noble and Hassler (1936) and Dunn (1937) have shown that there are no morphological differences correlated with the different color-pattern types.

From the material now available it is clearly demonstrated that the "normal" striped and the evittate, as well as all degrees of intermediacy, are found throughout the range of the species. In some areas the frequency of evittate individuals is high, but when these occur in such distant areas as Maryland and coastal Texas, the presence or absence of a lateral stripe loses significance as a systematic character. Consequently, *Hyla evittata* Miller should be considered a strict synonym of *Hyla cinerea* Schneider.

Hyla cinerea breeds in southern Florida from mid-May to early October. Calling males are usually found on bushes and trees, seldom on the ground. They have been observed about 15 feet above the ground in palm trees. Daytime retreats include axils of palm fronds and shaded branches in hammocks.

Food items found in stomachs of ten individuals included 2 elaterid and 2 scarabaeid beetles, 1 lepidopteran larva, 1 chalcid, and 12 termites.

Hyla cinerea is found throughout southern Florida and the keys with the exception of mangrove swamps and salt marshes. It is particularly abundant in willow clumps along canals and sloughs, in mesophytic hammocks, and in cypress swamp. It is least abundant in the sandy pineland. Locality records for 455 specimens are:

Broward County: 2 mi. W Davie (2), 8 mi. W, 5 mi. S Hallandale (1), Hollywood (9), 10-mi. S Pompano (1). *Collier County*: 2.5 mi. E Carnestown (5), 1.3 mi. WNW Collier-Dade Co. line (2), Deep Lake (2), 2.1 mi. N Deep Lake (8), Everglades (1), Marco Island (7), 2.9 mi. W Monroe Station (28), 8.6 mi. E Monroe.

Station (6), Naples (3), 3-5 mi. SE Naples (19), 7-9.4 mi SE Naples (19), 4.2 mi. N Naples (3), 4.3 mi. E Ochopee (53), 2.5 mi. W Ochopee (3), 5 mi. W Ochopee (1), Royal Palm Hammock (11), Tamiami Trail (1), Turner River (3). *Dade County*: Coconut Grove (1), Coral Gables (2), 14 mi. W Coral Gables (1), 16 mi. SW Coral Gables (2), 4.2 mi. S Florida City (3), 5.2 mi. E Florida City (1), Homestead (13), Lemon City (12), Little River (1), Matheson Hammock (1), Miami (47), 7 mi. W, 2.5 mi. N Miami (7), 8.2 mi. W Miami (13), 16.9 mi. W Miami (57), 18 mi. W Miami (5), 22.7 mi. W Miami (1), Medley (1), Paradise Key (33), 6.5 mi. SW Paradise Key (12), 9.3 mi. N, 5.2 mi. E Paradise Key (1), 20 mi. N Paradise Key (2), Perrine (1), South Miami (1). *Monroe County*: Big Pine Key (9), Cudjoe Key (13), Flamingo (7), Islamorada, Upper Matecumbe Key (1), Matecumbe Key (1), 5.5 mi. S, 6.3 mi. E Monroe Station (2), 50 mi. W Miami (1), Pinecrest (11).

Hyla femoralis Bosc

The largest specimen examined is a female with a snout-vent length of 39 mm. Thirty-eight males have an average snout-vent length of 30.7 mm., tibia length of 14.8 mm., and snout-vent/tibia ratio of 45.8 percent; 19 females average 34.2 mm., 15.6 mm., and 45.6 percent. Usually there is a dark brown stripe separating the reddish dorsal ground color from the white venter. In specimens from southern Florida this stripe is distinct in most, but in 25 percent it is poorly defined, and in 3 percent, it is absent. Individuals from northern Florida (Silver Springs) are much like southern specimens in this respect. In a series of 22 males from Charleston, South Carolina, only 27 percent have a distinct stripe, whereas the stripe is poorly defined in 50 percent and absent in 23 percent. Some individuals were greenish gray or pale green when found. One from Marco Island is pale greenish gray with little suggestion of a dorsal pattern, consequently giving the appearance of *Hyla squirella*. Although we have not observed individuals changing color, Wright and Wright (1949: 323) intimate that the species exhibits metachrosis.

For the most part *Hyla femoralis* is associated with pine forests; two specimens have been found in the rosemary scrub association on Marco Island. It lives in the sandy areas and not in the rocky pine-land.

In southern Florida breeding takes place from June to early October. A large chorus was encountered 3 miles southeast of Naples on 5 July 1953. The males were calling from vines, grasses, and shrubs to a height of about two feet above the water in a temporary pond in the pine flatwoods. Claspings pairs were found on boles in the pines, and other pairs were seen higher on the trees than one could reach. Drainage in the pine flatwoods is rapid, and a heavy rain must fall before any appreciable amount of standing water can

be found. Consequently, breeding choruses of *Hyla femoralis* are likely to be heard only after heavy rains.

The stomachs of 20 individuals were examined for food remains; of these one was empty, and two contained only plant material (bark and plant buds). The others contained mostly insect remains, as follows: 4 grasshoppers (Tetrigidae), 1 cricket (Gryllidae), 6 beetles (Carabidae, Elateridae, Scarabaeidae), 1 caddisfly, 2 ants (Formicidae), 4 wasps (Vespidae), 3 unidentified insects, and 1 jumping spider (Attidae).

Hyla femoralis just enters the area of study; in peninsular Florida its range terminates in the sandy pine flatwoods of southeastern Broward County and western Collier County. It does not occur in the cypress forests nor in the Everglades. Locality records for 63 specimens are:

Broward County: 1 mi. N Hallandale (1), 10 mi. S Pompano (3). *Collier County*: Marco Island (2), 3 mi. SE Naples (41), 4.6 mi. NW Royal Palm Hammock (16).

Hyla gratiosa Le Conte

Twenty-six males from Collier County vary in snout-vent length from 54.4 to 70.3 (61.5) mm.; two females have snout-vent lengths of 56.8 and 58.2. Examination and comparison of 30 specimens from southern Florida with 45 individuals from Gainesville and 27 from South Carolina shows that specimens from southern Florida resemble those from South Carolina most closely in size; specimens from Gainesville are slightly smaller. Specimens from the western part of southern Florida, however, are at once distinguishable from individuals from South Carolina on differences in color pattern. Specimens from North Carolina, South Carolina, Georgia, and Louisiana are characterized by having a prominent white line along the upper lip posterior to the tympanum, a distinct white line along the outer margin of the forearm, a definite white line dorsal to the vent, and a yellowish line beginning at the shoulder and proceeding posteriorly along the side. Specimens from southern Florida (exclusive of Broward County) have the lip line absent or almost so due to encroachment of pigments from above the lip, the white line along the forearm absent or almost so, white pigmentation above the vent and in the groin scattered and not forming a white bar, and the yellowish lateral lines indistinct and blending quickly into the lateral pattern of spots, or represented only by a short lateral bar immediately behind the shoulder. Specimens from Broward County seem typical of *Hyla gratiosa* as it occurs in South Carolina and Georgia.

This species has been taken only in the vicinity of ponds, usually with cypress as the predominant tree, but occasionally in low ponds in flatwoods where cypress was absent. These ponds are located in sandy pineland, where *Pinus clausa* occurs. Calling males have been heard from mid-June through September. Usually males call while floating in water with the head and vocal sac above the surface and the legs distended posteriorly. Such aquatic males take alarm easily and often escape capture. One calling male was taken from the top of a three-foot high cypress stump, and two silent males were taken from boles of living cypress trees. Claspings pairs were collected in the water. When calling from the water, the males usually were in open areas away from vegetation; however, occasionally a male was heard calling from dense cover.

The stomachs of the individuals examined were empty.

Hyla gratiosa previously has not been reported from southern Florida. Carr (1940: 60) listed Hillsborough County on the west coast and Saint Lucie County on the east coast as the southernmost localities where this frog had been taken. Also he listed no counties in the central part of the state to the south of Marion and Osceola counties. Apparently *H. gratiosa* extends southward along the coastal areas, and the southern populations are separated by the broad expanse of the Everglades and the more northern prairies. The differences pointed out between individuals from Broward County and those from the western counties are probably related to the absence of genetic continuity between these terminal populations, except via breeding populations to the north along the peninsula. Locality records for 32 specimens are:

Broward County: No additional data (2), 10 mi. S Pompano (2). *Collier County*: 2.1 mi. N Deep Lake (2), 3 mi. SE Naples (16), 4.2 mi. N Naples (8), 13.6 mi. NW Royal Palm Hammock (2).

Hyla septentrionalis Boulenger

Barbour (1931b) first reported the presence of this species in Florida; he mentioned that old residents of Key West recalled that the frogs had always been there. *Hyla septentrionalis* is widely distributed in the Bahama Islands and Cuba; it has relatives throughout the Antilles. Obviously this group of frogs is capable of insular dispersal, so there is little reason to consider *Hyla septentrionalis* as a species introduced into the fauna of the United States. Schwartz (1952b) first reported the species from the mainland.

In size the females are much larger than males; the largest female examined has a snout-vent length of 96.5 mm.; the largest male,

61.6 mm. There is little difference in the size and proportions of individuals from Key West and those from Miami (table 7). In life the dorsal ground color changes from light green to ashy gray to light brown, sometimes to reddish brown. The dorsal markings are dark gray to dark olive green or deep brown. Usually the markings form reticulations, but this is highly variable (fig. 21).

TABLE 7
MEAN MEASUREMENTS AND PROPORTIONS OF *Hyla septentrionalis*
IN SOUTHERN FLORIDA.

Locality	Sex	N	Body length	Tibia length	Tibia length	Head width	Head width
					Body length		Body length
Miami	♂	20	57.5	26.5	46.2%	17.7	30.7%
	♀	7	71.7	34.1	47.6	23.3	33.2
Key West	♂	20	53.0	24.0	45.3	16.6	32.9
	♀	10	78.6	36.1	46.1%	26.1	33.3%

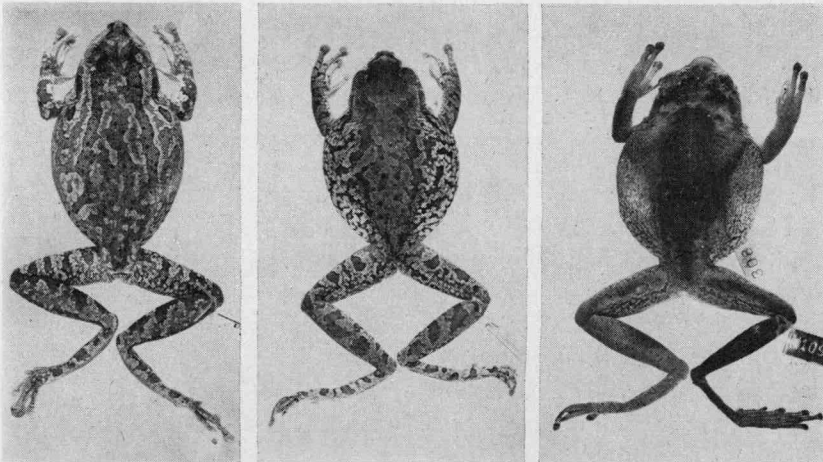


Figure 21.—Variation in the dorsal color pattern in *Hyla septentrionalis* from Miami.

Calling males have been encountered from early March to early September. On 7 September egg masses were observed in an outdoor aquarium in Miami; these formed a thin sheet on the surface of the water. A captive female laid 130 eggs in an aquarium. Twenty-four hours after deposition the average diameter of the outer envelope (10 eggs) was 3.0 mm.; that of the inside envelope 2.4 mm.; that of the

embryo 2.0 mm. Shortly before hatching the largest embryo was 2.8 mm. in length. Eggs laid on 10 July hatched 27½ hours after deposition. Forty-eight hours after the eggs were laid the tadpoles averaged 2.1 mm. in snout-vent length and 3.8 mm. in tail length. The abdominal region was swollen with yolk; the eyes were covered, and stout, rounded gills were present (fig. 22). At an age of five days the tadpoles had a snout-vent length of 3.9 mm. and a tail length of 5.1 mm.; at seven days these increased to 4.2 and 6.0 mm., and at twenty days to 6.0 and 8.4 mm. At 54 days the average snout-vent length was 12.6 mm. and tail length 19.6 mm. No limbs had appeared at this time. The tadpoles have a round body and a wide caudal fin. They are predominantly black above; the fleshy part of the tail is grayish brown; the fin is transparent with scattered melanophores (fig. 23). The teeth are arranged in six rows: one complete and one incomplete row above the horny beak; and three complete and one incomplete rows below the beak (fig. 24). Sixteen recently transformed young collected on 25 July 1952, have an average snout-vent length of 12.6 mm.; the tibia/snout-vent ratio is 0.50, and the head width/snout-vent ratio is 0.33. The young have a ground color that is pale green to light tan with a rather broad dorsolateral cream to yellow stripe. The young individuals were found clinging to leaves of bushes and blades of grass in and around a pond.

Peterson, Garrett, and Lantz (1952) reported collecting breeding individuals of *Hyla septentrionalis* from brackish water on Key Vaca. If the eggs and tadpoles of this species are capable of development in brackish water, since fresh water is lacking on some islands, this ability would be helpful in the dispersal of the species throughout the chain of Florida Keys.

Stomach contents of twenty individuals from Miami revealed an assortment of arthropod remains: 5 beetles (Curculionidae, Scarabaeidae, Elateridae), 1 roach (Blattidae), 1 cricket (Acrididae), 6 bugs (Cercopidae, Scutelleridae), 2 lepidopteran larvae, 1 may-fly, 24 pill bugs, and a small crustacean.

Hyla septentrionalis is an inhabitant of mesophytic and edificarian situations. It is unknown from the prairie and pineland habitats. At Key West the frogs are commonly found in old cisterns, and a resident informed us that they are sometimes found in toilet bowls! These frogs are distributed over the Florida Keys and are abundant in certain areas in Miami. Allen and Neill (1953) mentioned the presence of this species at Paradise Key, where it had been released some years before. No specimens are available from that locality. Locality records for 227 specimens are:

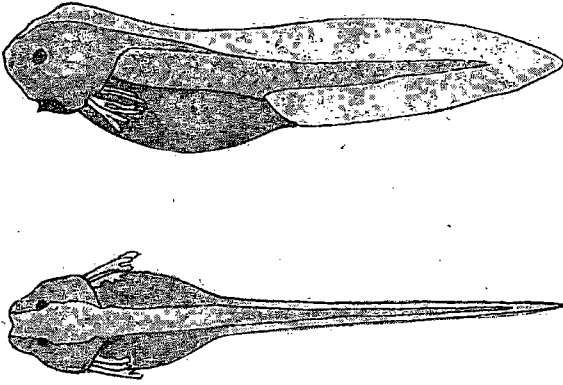


Figure 22.—Forty-eight hour tadpole of *Hyla septentrionalis*. Total length 5.9 mm.

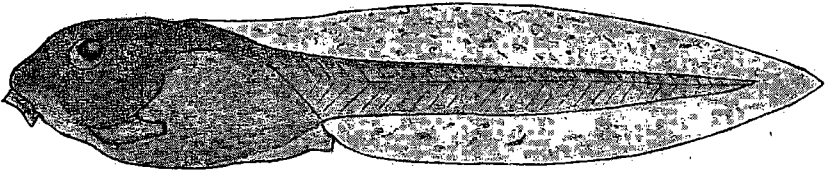


Figure 23.—Fifty-four day tadpole of *Hyla septentrionalis*. Total length 32.2 mm.

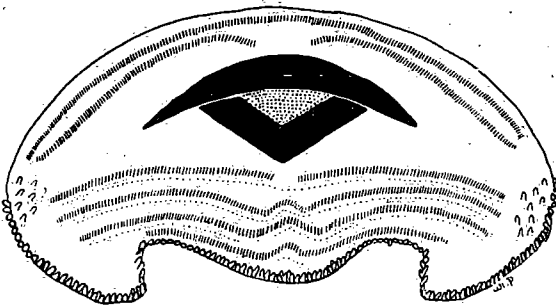


Figure 24.—Mouthparts of fifty-four day tadpole of *Hyla septentrionalis*.

Dade County: Miami (45). *Monroe County:* Big Pine Key (1), Key Largo (1), Key Vaca (35), Key West (102), Matecumbe Key (2), Stock Island (22), Upper Matecumbe Key (19).

Hyla squirella Bosc

The dorsal ground color of specimens from southern Florida may be either unicolor greenish gray or light brown, or variously mottled or spotted with dark greenish or brown (depending upon the ground color of the individual); often there is an interocular dark bar. Sixty adult males have snout-vent lengths from 24.2 to 43.0 (32.6) mm., 21 females, 23.3 to 35.1 (29.0) mm. Comparison of four series of *H. squirella* from various localities indicates that specimens from southern Florida show striking variation (table 8). Whenever possible, the 15 largest individuals of each sex from each area were measured. A series from Collier County, when compared with specimens from Miami, and specimens from Charleston County, South Carolina, and Marion County, Florida, shows that the populations west of the Everglades are noticeably smaller in the measurements taken. The series from Miami is comparable in all measurements (although there are certain slight average differences) to specimens from northern Florida (Marion County) and South Carolina. Average differences in the size of the sexes is not striking.

TABLE 8

AVERAGE MEASUREMENTS OF FOUR SAMPLES OF *Hyla squirella* FROM
SOUTHEASTERN UNITED STATES.

Locality	Sex	N	Body length	Tibia length	Foot length	Head width	Head length	Interorbital distance
Charleston,	♂	15	33.0	12.9	12.6	10.5	9.4	3.1
South Carolina	♀	6	33.4	12.7	11.8	10.2	9.0	2.8
Marion County,	♂	15	31.6	12.6	13.0	10.9	9.3	3.1
Florida	♀	15	33.4	13.2	13.6	11.1	10.0	2.9
Miami, Florida	♂	15	33.9	12.0	11.6	10.9	9.3	2.8
	♀	7	31.5	11.2	11.2	9.7	8.7	2.8
Collier County,	♂	15	26.6	9.3	9.1	8.1	7.3	2.2
Florida	♀	14	27.8	10.4	10.3	9.0	8.6	2.3

Material from the Florida Keys is not abundant. Fifteen adult males from the lower keys have an average snout-vent length of 32.9 mm., and thus are more like the specimens from Miami. A

series of 15 males from Miami Beach have an average snout-vent length of 36.9 mm., with the largest being 43.0 mm.; these are the largest specimens of *H. squirella* examined. The discrepancy in size between Miami, Miami Beach, and Collier County individuals is noticeable in the field; these differences are even more striking in the laboratory, when males from these three localities are placed side by side.

This frog has been taken in all major habitats in southern Florida except mangroves; however, specimens from the vicinity of Flamingo were collected while in chorus on a prairie adjacent to a marine canal; and undoubtedly the frogs occupy mangroves in such areas. When calling, this frog utilizes almost any small body of water, but temporary rain pools of moderate depth seem to be preferred. Vocalizing individuals often perch on debris and twigs above the water, but they have been seen singing from the water, on the ground near water, and hidden in clumps of grass. When calling, the frogs create an almost unbearable din with their raucous voices, which resemble a harsh, short, ascending scale; the noise so created is especially distracting when it results from a chorus in a confined area, such as a deep sink hole. Loud choruses often completely obscure the calls of other species in the same pond. When not calling, *H. squirella* has been collected in hammocks, under logs and debris, in the palm thatching of a Seminole *cheki*, and upon the rails of bridges along the Tamiami Trail on rainy nights. Numerous individuals were found during the day beneath the bark of dead pine stumps west of Homestead. This is the only hylid frog so encountered.

The "rain call" of *H. squirella* is familiar to most residents of southern Florida. This call is uttered by lone males from trees and bushes (usually during the day) when the weather becomes cloudy and sultry and rainfall is impending. The call is a raucous quack and differs from the breeding call. This species seems more sensitive to pre-precipitation weather changes than most other frogs in the area. In Miami, on one occasion, no *H. squirella* were heard calling until a warm, sultry northern wind began. As the velocity of the wind increased (without rain), the frogs began vocalizing in gradually increasing numbers, so that by the time the rain began they were in loud chorus. Dates for chorusing of *H. squirella* range from 30 March to 8 August.

Stomachs of 20 individuals were examined and the following food items were noted. Nine stomachs were empty; two contained only plant debris, and beetles (in two cases identified as Elateridae) were

found in four stomachs. Crustacean remains (? very small crayfish) were identified from two frogs, and remains of a spider, a cricket, and an ant each were encountered in a single stomach.

Hyla squirella is widespread in southern Florida. It occurs throughout the keys. Locality records for 685 specimens are:

Broward County: 1 mi. W Davie (52), 2 mi. W Davie (31), Hallandale (28), Hollywood (48). *Collier County*: 1.3 mi. WNW Collier-Dade Co. line, Tamiami Trail (5), 2.1 mi. N Deep Lake (12), Everglades (7), 8.6 mi. E Monroe Station (41), Naples (1), 1-3 mi. SE Naples (10), 6-10 mi. SE Naples (3), Royal Palm Hammock (40), 4.6 mi. NW Royal Palm Hammock (2), 8-13 mi. NW Royal Palm Hammock (10), Tamiami Trail (1). *Dade County*: Coconut Grove (6), Coral Gables (8), 16 mi. SW Coral Gables (1), 1.5 mi. SE Florida City (28), 4.3 mi. W Florida City (4), Homestead (37), Lemon City (14), Long Pine Key (9), Matheson Hammock (1), Miami (105), 7 mi. W Miami (20), 20 mi. W Miami (15), Miami Beach (33), Opa-locka (1), Paradise Key (23), 6.5 mi. SW Paradise Key (3), 20 mi. N Paradise Key (1), Uleta (12). *Monroe County*: Big Pine Key (14), Boca Chica Key (1), Coot Bay (1), Cudjoe Key (1), Flamingo (22), 1 mi. NE Flamingo (4), Key Vaca (3), Key West (2), Lignumvitae Key (2), Little Torch Key (12), Long Key (4), Lower Matecumbe Key (1), Matecumbe Key (5), Pinecrest (1).

Gastrophryne carolinensis carolinensis Holbrook

Engystoma carolinensis Holbrook, 1836, North American Herpetology, ed. 1, vol. 1, p. 83.

Eighty-seven males have snout-vent lengths from 18.8 to 30.5 (26.2) mm.; 49 females, from 22.4 to 32.5 (28.3) mm. The dorsal color pattern varies from an almost unicolor tan with only a faint indication of the dorsal blackish stripes to a dorsum with two light bands, each edged heavily in black. The venter may be heavily spotted or may be tan and relatively unicolor. These differences in coloration have led Hecht and Matalas (1946) to segregate specimens from the Florida Keys into three categories: 1) *carolinensis*—dorsum dark and blotched or with indistinct dorsolateral stripes, and venter mottled; 2) "Key West"—dorsal pattern of two prominent light tan dorsolateral stripes bordered by a distinct dark margin on a tan background; 3) *olivacea*-like—virtually without pattern and thus with a uniformly light tan dorsum, with ventral coloring usually much reduced. They found (1946: 3) that 39 specimens from the keys might be divided into 9 *carolinensis* (23%), 19 "Key West" (48%), and 11 *olivacea*-like (29%). Examination of a series of 78 other individuals from the keys shows that 12 percent are *carolinensis*, 34 percent are "Key West," and 24 percent are *olivacea*-like. Intermediates between "Key West" and *carolinensis* formed 9 percent of the sample, and intermediates between "Key West" and *olivacea*-like made up 21 percent. Thus of

78 specimens, only 12 percent are strictly comparable to *G. c. carolinensis*, whereas 88 percent show other types of coloration. Populations of *Gastrophryne* on the keys show differences in pigmentation and patterning; isolation by salt water probably has been responsible in establishing these patterns on the islands, apparently to the detriment of the typical *carolinensis* pattern. A series of 48 individuals from Miami shows that 56 percent are *carolinensis*, 16 percent are "Key West," 2 percent are *olivacea*-like, and 25 percent are intermediate between "Key West" and *carolinensis*. Thus, on the southern Florida mainland the population still shows the mixed character which is noted on the keys, although the preponderance of specimens shows a *carolinensis* pattern. Finally, 36 specimens from South Carolina show 86 percent *carolinensis* characters, and 14 percent (5 specimens) are variously intermediate.

Gastrophryne is common around human dwellings, often being taken under trash and boards in the vicinity of houses during the day. A single individual was taken from the house of a wood rat (*Neotoma floridana*) on Key Largo. Other than under debris, this frog is seldom seen during the day; small individuals were seen abroad on two occasions.

The call is a sheeplike "baaa" which, when accompanied by large choruses of other amphibians, may be virtually inaudible in the general din. Choruses exclusively of *Gastrophryne* are seldom heard. The shy males call from sheltered situations, often from beneath trash at the edge of the water or partially buried in grass. The call is given with the head protruding above the surface and with the hind legs widespread as the frog lies extended in the water. At times the males give voice on the bank away from the pond; in instances when these individuals have been found, they were located in small depressions filled with water. Calling males have been collected between 27 April and 9 July, and presumably breeding takes place within this period.

Examination of several stomachs shows that the diet of these frogs consists solely of ants. The taking of an individual in an ant nest in Tennessee has been mentioned by Wood (1948).

Gastrophryne occurs throughout southern Florida on the mainland and on the keys. Locality records for 278 specimens are:

Broward County: 2 mi. W Davie (5), Ft. Lauderdale (1), 6 mi. W Ft. Lauderdale (3), 2 mi. S junct. Ft. Lauderdale road and Okeechobee-Miami road (1), Hallandale (2), Hollywood (10). *Collier County*: Everglades (2), 3.7 mi. SE Naples (1), 7.5 mi. SE Naples (2), 2.8 mi. S Miles City (1). *Dade County*: Coral Gables

(1), 5 mi. E Florida City (1), 1.5 mi. SE Florida City (26), Hialeah (1), Homestead (2), 6 mi. S Homestead (2), Miami (56), 7 mi. W, 2.5 mi. N Miami (8), 17 mi. W Miami (6), 19 mi. W, 3 mi. S Miami (1), Miami Beach (3), Miami Springs (2), Paradise Key (3), 5.2 mi. NE Paradise Key (1), 9 mi. W Paradise Key (3), Uleta (3). *Monroe County*: Big Pine Key (9), Coot Bay (2), Cudjoe Key (1), Key Largo (1), Key West (82), Lignumvitae Key (8), Little Torch Key (2), Matecumbe Key (7), Pinecrest (3), Stock Island (9), Sugarloaf Key (2), Summerland Key (5).

Rana areolata aesopus Cope

Rana areolata aesopus Cope, 1886, Proc. Amer. Phil. Soc., vol. 23, p. 517. Neill, 1957, Herpetologica, vol. 13, pt. 1, p. 52.

On 19 April 1957, Dennis R. Paulson collected one individual of this species in a cypress bottom in the relatively dry scrub area near North Naples, Collier County. Others have been heard calling in the vicinity of Naples. That this locality is not extremely disjunct from the rest of the range is shown by records of the species in Charlotte County (L. Neil Bell, *in litt.*) and Okeechobee County (D. R. Paulson, *in litt.*). The specimen from North Naples (DRP 500) is a male with a snout-vent length of 95 mm. and constitutes the only locality record.

Rana grylio Stejneger

Thirteen adult males have snout-vent lengths from 96.7 to 117.0 (106.0) mm., 12 females, from 98.1 to 135.6 (115.2) mm. The tibia/snout-vent length ratio is greater in males (46.1% as opposed to 44.1% for females); the diameter of the tympanum/head width ratio is 41.6 percent in males and 27.2 percent in females. The dorsal ground color varies from pale green to grayish green or light olive green. The dorsal markings are dark olive green to brown or black. The belly is creamy white; the undersurfaces of the hind limbs are boldly mottled with dark gray or black. Usually there are some dark spots on the abdomen and a large dark area in the thoracic region. In some there is a gray and cream mottling over the entire ventral surfaces (fig. 25). In comparison with specimens from northern Florida and southern Mississippi, individuals from southern Florida seem to have less brown pigment in the dorsal coloration and to have a more boldly marked venter.

Six juveniles collected on 18 May 1952, have an average snout-vent length of 36.6 mm. Dorsally they are colored like adults, but the ventral surfaces are cream with dark chocolate-brown mottling.

Rana grylio occurs most commonly in the wet prairies and occasionally in sloughs. The optimum habitat appears to be moderately

open prairie with a subsurface mat of vegetation upon which to rest. Juveniles were collected in masses of water hyacinths.

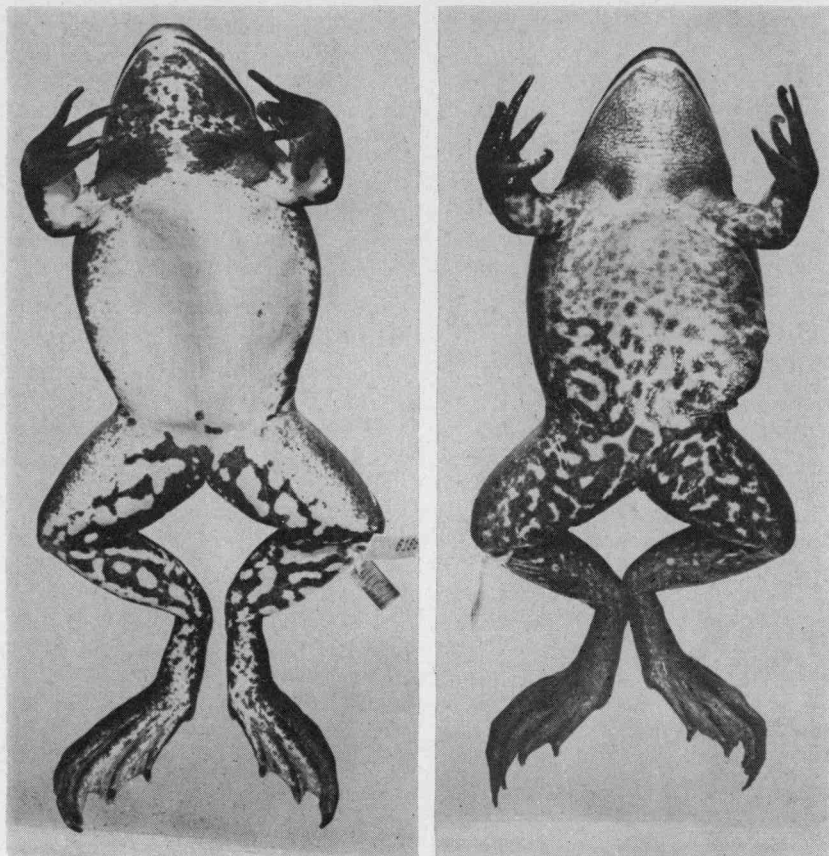


Figure 25.—Variation in the ventral markings of *Rana grylio* from the Everglades in Dade County.

The piglike grunts of the males are heard throughout the year; however, even at the height of the breeding season, apparently in June and July, choruses are not encountered. Individual males call from scattered spots in the prairie. Tadpoles have been observed in sloughs that were choked with water hyacinths.

Examination of food remains in the stomachs of ten adults revealed: 2 beetles (Dystiscidae and Scarabaeidae), 5 bugs (Belostomatidae), 6 wasps (Vespidae), 2 grasshoppers (Acrididae), 2 spiders (Lycosidae), and 1 crayfish (*Procambarus alleni*). Stomachs from eight

juvenile frogs contained: 14 aquatic beetles (Dystiscidae, Haliplidae, and Hydrophilidae), 1 bug (Naucoridae), 1 earwig (Forficulidae), 1 spittle-bug (Cercopidae), 1 chalcid (Chalcididae), and 2 spiders (Lycosidae). Data on the feeding habits of *Rana grylio* supplied by the Game and Fresh Water Fish Commission of the State of Florida indicate that the principal foods are: crayfish (*Procambarus allenii*) very frequent, leeches (*Placobdella rugosa*) occasional, aquatic Hemiptera and Coleoptera frequent, spiders frequent, fishes (primarily small cyprinodonts and poeciliids) frequent, and occasional small vertebrates (*Hyla cinerea*, *Rana pipiens*, juvenile *Rana grylio*, and *Natrix sipedon*). Carr (1940: 67) stated that crayfish were present in about 40 percent of the many specimens he examined.

The value of *Rana grylio* as a food item for man has been the cause for reduced size of populations in southern Florida. Frogging is highly commercialized, and large numbers of this species and *Rana pipiens* are secured by gigging from air boats at night.

Rana grylio is widely distributed in the Everglades but does not occur in the pinelands nor on the keys. Locality records for 62 specimens are:

Broward County: Hollywood (3). *Collier County*: 2-4 mi. NW Carnestown (2), 2.7 mi. S Miles City (1), 6 mi. E Monroe Station (1), 10.3 mi. E Monroe Station (2), 5 mi. SE Naples (1), 9.4 mi. SE Naples (2), 11.1 mi. SE Naples (2), 7.2 mi. E Ochopee (1), 7.1 mi. W Ochopee (1), 12.1 mi. W Ochopee (1), 18.9 mi. W Ochopee (1), 10-12 mi. E Royal Palm Hammock (2), 11 mi. W Royal Palm Hammock (2). *Dade County*: Homestead (1), Lemon City (1), Miami (5), 6 mi. W Miami (1), 17-25 mi. W Miami (16), 40 mi. W, 2.6 mi. NW Miami (1), Paradise Key (7), 10 mi. SW Paradise Key (1). *Monroe County*: 45 mi. W Miami (1), Pinecrest (6).

Rana pipiens Schreber

Rana pipiens Schreber, 1782, Naturforscher, vol. 18, p. 185, pl. 4.

Rana halecina sphenocéphala Cope, 1886, Proc. Amer. Phil. Soc., vol. 23, p. 517.

In specimens from the Everglades and surrounding pineland, the dorsal color pattern typically consists of elongated dark brown spots on a light tan or green ground color; the dorsolateral folds are prominent and usually of a bright yellow color. The transverse bands on the femur are incomplete; the posterior surfaces of the thighs and the lip region are mottled with brown and cream or white. The undersurfaces are white or cream, and the brown tympanum usually has a central yellow spot. The above description is adequate for most specimens from the mainland; however, those from Marco Island, Collier County, may exhibit a slightly different coloration, whereas those from the lower keys are strikingly different (fig. 26).

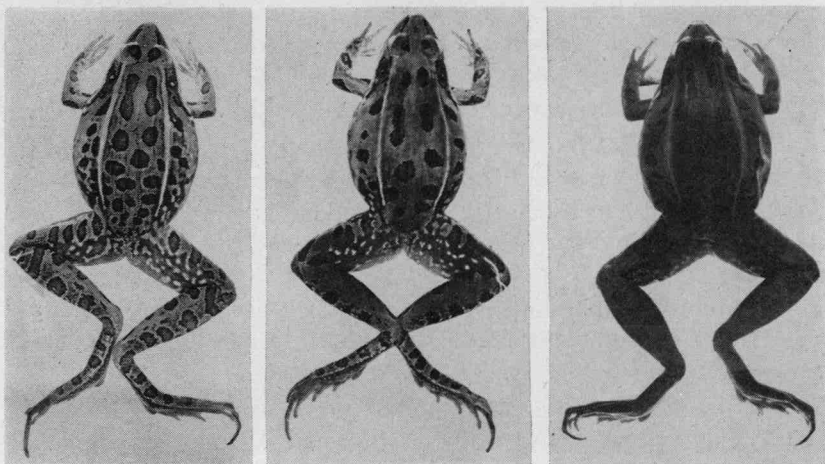


Figure 26.—Variation in the dorsal coloration of *Rana pipiens*. The individual on the right is from Big Pine Key, Monroe County, and is typical of the coloration exhibited by the population on the keys. The other two individuals are from Hollywood, Broward County, and show the normal variation in coloration exhibited by the population on the mainland.

Specimens from Marco Island usually are darker in over-all coloration than individuals from the mainland. The dorsal ground color is dark green; the spots often are nearly black. The belly is a dirty white and mottled with dark brown or black in the throat region. Series of specimens from Big Pine Key, Little Torch Key, and Key West are very dark. The dorsal ground color is a dark brownish black; the dorsal spots are black, and the ventral color is a grayish to brownish cream, the throat and flanks often being heavily mottled with dark gray or black. In the large adults the dorsolateral fold usually is a bronze color. The light tympanic spot is present. Although young individuals from the keys are darker than specimens of a similar size from the mainland, they are not so dark as the adults. Apparently, the dark pigmentation increases with age.

The isolated insular populations of *Rana pipiens* show a coloration very similar to that displayed by individuals of the species from southern Arizona. Duellman (1955b: 5) in discussing the Arizona frogs postulated that the coloration might be an expression of environmental conditions and not be genetically controlled.

The largest female from the mainland has a snout-vent length of 99.6 mm.; the largest male, 85.2 mm. The largest individuals of each sex from the keys are from Big Pine Key and measure 97.7 mm. (female) and 80.0 mm. (male). The smallest completely transformed

specimen also is from Big Pine Key; it has a snout-vent length of 24 mm. There are no significant differences in measurements and proportions between the series from the lower keys and the mainland. Only the coloration seems to be consistently different.

Rana pipiens inhabits all areas of the mainland of southern Florida where there is permanent water. Large populations thrive in the Everglades, but the frogs also are abundant in sloughs, canals, and rockpits. On Big Pine Key they inhabit a few large pot holes, an abandoned well, and a roadside ditch. On Marco Island several were found in an abandoned well, and on 3 July 1954, large numbers were found in temporary ponds between the beach and a mangrove swamp. In September, 1954, at West Lake near Coot Bay Ranger Station numerous small *Rana pipiens* were seen leaping from the roadbed into the brackish water of the mangrove swamp. Deckert (1922) mentioned seeing many *Rana pipiens* along the bank of a brackish canal between Paradise Key and Cape Sable.

The possible adaptations of *Rana pipiens* to brackish water is an interesting problem in the life history and ecology of this frog in southern Florida. The specimens found in the vicinity of Coot Bay are several miles from any permanent body of fresh water, for the broad expanse of the Everglades gradually merges with the brackish coastal prairies and mangrove swamps. At times of heavy rain and corresponding high water in the Everglades, fresh water extends farther toward the coastal areas than it does at time of drought. This brings about a fluctuation of salinity and a stratification of salt and fresh water. Although frogs have been seen submerged and swimming in water that was definitely brackish, no eggs or tadpoles have been found in brackish water. Certainly the frogs do not move inland to breed; even though *Rana pipiens* may be capable of moving considerable distances within a relatively short period of time, it is doubtful if the whole population moves several miles to breed! Also, the presence of many small and less mobile frogs, such as *Acris gryllus*, *Hyla squirella*, and *Gastrophryne carolinensis*, negates that possibility. Possibly there is a certain amount of tolerance to saline conditions by the tadpoles and perhaps the eggs. A conclusion can be reached only after laboratory experimentation.

Carr (1940: 68) stated that *Rana pipiens* in Florida breeds every month of the year. Males may be heard throughout the year, but it is doubtful if breeding activity is continuous. They have been noted breeding in southern Florida from May to December. Deckert (1921: 21) recorded *R. pipiens* breeding at Lemon City on 5 December 1920,

where he found three batches of eggs partly floating and attached to weed stems in about 12 to 15 inches of water in a rock pit. On a rather cold day in February nearly 50 *R. pipiens* were found huddled in a mass under a large board about 30 feet from a canal near Pinecrest. They were quite lethargic and reluctant to move.

The following invertebrates were found in 24 stomachs: 2 centipedes (Scolopendridae), 4 grasshoppers (Tetrigidae), 1 roach (Blattidae), 1 squash bug (Coreidae), 6 beetles (Carabidae, Scarabaeidae, and Tenebrionidae), 4 lepidopteran larvae, 6 ants (Formicidae), 2 spiders (Lycosidae), and 5 snails (Helicinidae). One specimen from Big Pine Key contained a *Hyla squirella*, and two adults from Marco Island had eaten full grown *Bufo quercicus*.

Rana pipiens is found in all situations where permanent water is present on the mainland and on the lower keys. Locality records for 222 specimens are:

Broward County: Ft. Lauderdale (1), Hollywood (15). *Collier County*: Carnestown (1), 5.1 mi. N Carnestown (1), Deep Lake (2), Everglades (1); Marco Island (12), 3-5 mi. SE Naples (7), 8-10 mi. SE Naples (5), 2.5 mi. W Ochopee (1), Royal Palm Hammock (1), 3.9 mi. NW Royal Palm Hammock (2), 13.6 mi. NW Royal Palm Hammock (1), 7.9 mi. E Royal Palm Hammock (1). *Dade County*: Coral Gables (1), 7 mi. W Coral Gables (1), 2 mi. E Florida City (2), Homestead (2), 4-6 mi. S Homestead (6), 9 mi. N, 2 mi. W Homestead (3), Lemon City (3), Miami (31), 17-19 mi. W Miami (5), 19 mi. W, 3-4 mi. S Miami (7), 24-25 mi. W Miami (3), 36 mi. W Miami (5), Paradise Key (5), 2.1 mi. E Paradise Key (1), 1.3 mi. N, 5.2 mi. NE Paradise Key (3), 20 mi. N Paradise Key (2), 1.5 mi. SW Paradise Key (1), 15.9 mi. SW Paradise Key (1). *Monroe County*: Big Pine Key (59), Key West (12), Little Torch Key (6), Pinecrest (11), Ramrod Key (1).

Chelydra osceola Stejneger

Chelydra osceola Stejneger, 1918, Proc. Biol. Soc. Washington, vol. 31, p. 39.

Chelydra serpentina osceola, Rust, 1934, Blätter Aquarien-Terrarien-kunde, vol. 45, p. 59.

Chelydra osceola, Richmond, 1958, p. 41.

No large specimens of this species were secured during our field work in southern Florida. The largest specimen, a mature female, has a carapace length of 240 mm., carapace width of 188 mm. and a shell depth of 111 mm. A female with a carapace length of 155 mm. is not mature. The smallest juvenile has a carapace length of 28 mm., a carapace width of 29 mm., and a shell depth of 17 mm. The characters used by Richmond (1958) to distinguish *osceola* from *serpentina* apply equally well to our specimens from southern Florida.

The fleshy ventral surface, especially in the juveniles, is dark ashy gray to black with small cream flecks; in some there is fine cream mottling on the undersurfaces of the limbs. The dark color of the fleshy parts and of the plastron fades to a light gray or cream in the adults.

Chelydra has been encountered in canals, sloughs, and ponds. Juveniles were collected by seiving water hyacinths in side canals along the Tamiami Trail. Apparently the species is found in all fresh-water environments in southern Florida, but it probably reaches its greatest abundance in the canals in the Everglades. Locality records for 23 specimens are:

Collier County: Everglades (1), Naples (1), 13.6 mi. SW Royal Palm Hammock (1). *Dade County*: Biscayne Bay (1), Florida City (1), 4.2 mi. S Florida City (2), 18 mi. N Homestead (1), Miami (2), 15 mi. W Miami (2), 17 mi. W Miami (2), 19 mi. W, 3-6 mi. S Miami (3), 20-23 mi. W Miami (6).

Sternotherus odoratus Latreille

In specimens from southern Florida both the upper and lower beaks are black, and the latter usually has a pair of yellowish lines extending from its apex to its posterior ventral angle. The measurements in millimeters of the largest male and largest female are respectively: carapace length 68.0, 81.3; carapace width 46.2, 55.5; plastron length 46.6, 59.1; depth 29.5, 36.8; length of anterior lobe of plastron 15.9, 18.9; length of median lobe of plastron 11.9, 16.4; length of posterior lobe of plastron 19.1, 23.3; width of posterior lobe of plastron 20.6, 23.3; length of bridge 8.0, 11.5; width of head 16.0, 18.1. The smallest juvenile has a carapace length of 39.0 mm., plastron length of 25.7 mm., depth of 21.0 mm., and head width of 9.5 mm. Because of the paucity of specimens from southern Florida, comparisons have not been made with northern individuals.

Sternotherus has been taken only in the canals in southern Florida; the few specimens available have been secured by dipping water hyacinths and other aquatic plants from standing water. Although it is probably more common than the few records indicate, the present evidence points to the fact that *S. odoratus* is the least abundant of the three southern Florida kinosternids. The probable presence of this turtle in cypress ponds needs verification. Traps baited with flesh have not succeeded in taking this species in southern Florida.

Sternotherus odoratus occurs in aquatic habitats throughout the area and has been encountered most frequently in the Everglades; it does not occur on the Florida Keys. Locality records for 10 specimens are:

Collier County: 8 mi. WNW Collier-Dade Co. line, Tamiami Trail (1).
Dade County: 23.1 mi. W Miami (2), 24.2 mi. W Miami (1), 33 mi. W Miami (1),
 Miami Springs (1), Paradise Key (2). *Monroe County*: Pinecrest (2).

Kinosternon bauri bauri Garman

Kinosternon baurii Garman, 1891, Bull. Essex Inst., vol. 23, p. 141.

Kinosternon bauri bauri, Uzzell and Schwartz, 1955, p. 33.

The subspecies of *Kinosternon bauri* have been redefined by Uzzell and Schwartz (1955) who have shown that the nominal form is restricted to the lower keys. This population is characterized by a dark carapace, usually having the light lines obscured and the lower beak either unstreaked or with very weak streaks. Comparisons of measurements and proportions of specimens from the lower keys and from the mainland are given in table 9. The largest male of *K. b. bauri* is from Stock Island and has a carapace length of 103.9 mm.

Specimens on Big Pine Key were secured by baiting traps with small mammal carcasses. The turtles came to the bait during daylight hours, indicating that they may do some of their foraging by day. Individuals on the lower keys live in small permanent and temporary pools of fresh and brackish water; observers have noted them in mangrove swamp. The ability of the animal to survive in salt water probably has aided it in crossing the narrower channels between the keys; the distinct markings and coloration of the populations on the lower keys also tend to demonstrate that these populations are effectively isolated from populations on the upper keys by the wide channel today spanned by the Overseas Highway Seven-Mile Bridge.

As indicated by Uzzell and Schwartz (1955), *Kinosternon bauri* occurs only on the oölitic lower keys. Locality records for 33 specimens are:

Monroe County: Big Pine Key (17), Key West (11), 30 mi. N Key West (1), Stock Island (4).

Kinosternon bauri palmarum Stejneger

Kinosternon bauri palmarum Stejneger, 1925, Jour. Washington Acad. Sci., vol. 15, p. 463. Uzzell and Schwartz, 1955, p. 34.

The mainland and upper key populations of *Kinosternon bauri* recognized as the subspecies *palmarum* by Uzzell and Schwartz (1955) are characterized by a variably pigmented carapace and a heavily streaked mandibular beak. The scutes of the carapace are often transparent, the light color making the light lines on the cara-

pace indistinct; otherwise the lines are distinct. Measurements and proportions are given in table 9.

TABLE 9

MEANS AND OBSERVED RANGES OF MEASUREMENTS AND PROPORTIONS OF THE LARGEST MALES AND FEMALES OF *Kinosternon bauri* AVAILABLE FROM SOUTHERN FLORIDA. (15 MALES AND 15 FEMALES FROM THE MAINLAND, 6 MALES AND 15 FEMALES FROM THE LOWER KEYS).

Character	Sex	Mainland	Lower Keys
Carapace length	♂	87.6 (80.8-98.7)	89.1 (78.3-103.9)
	♀	107.6 (101.6-119.0)	89.8 (74.1-110.7)
Carapace width	♂	56.8 (50.4-63.7)	56.9 (50.3-64.6)
	♀	71.3 (68.5-78.3)	59.2 (49.5-73.2)
Plastron length	♂	70.7 (63.3-76.9)	75.6 (68.7-85.7)
	♀	99.2 (92.0-108.8)	79.6 (62.3-99.0)
Greatest depth	♂	34.5 (30.8-40.1)	33.4 (29.7-38.1)
	♀	46.3 (41.2-51.3)	36.3 (27.8-48.4)
Length of anterior lobe	♂	25.4 (21.2-28.2)	25.5 (21.8-30.1)
	♀	31.9 (29.6-34.7)	26.2 (21.3-31.7)
Length of median lobe	♂	20.0 (16.8-22.0)	21.1 (19.2-24.0)
	♀	28.7 (25.0-33.7)	22.1 (16.3-28.9)
Length of posterior lobe	♂	25.4 (21.2-28.2)	26.6 (24.3-31.6)
	♀	37.7 (31.8-40.7)	31.2 (24.7-40.1)
Width of posterior lobe	♂	30.5 (24.8-33.8)	32.9 (27.6-38.7)
	♀	45.0 (40.4-47.4)	36.1 (28.8-45.0)
Length of bridge	♂	14.1 (12.4-16.9)	14.9 (12.2-18.4)
	♀	22.6 (19.4-25.2)	16.5 (12.7-23.5)
Length of bridge/ Carapace length	♂	.160 (.150-.179)	.167 (.151-.177)
	♀	.210 (.190-.231)	.183 (.162-.212)
Length of anterior lobe/ Length of bridge	♂	1.76 (1.56-1.91)	1.72 (1.63-1.86)
	♀	1.42 (1.26-1.58)	1.61 (1.35-2.04)
Carapace width/ Length of anterior lobe	♂	2.31 (2.16-2.42)	2.24 (2.07-2.40)
	♀	2.24 (2.04-2.49)	2.26 (2.07-2.38)

Carr (1952: 93) stated that *K. bauri* "is probably the least aquatic of the North American kinosternids . . . It likes to prowl on land during rains and may frequently be seen in temporary rain pools after thundershowers." Our observations substantiate this statement; most of the large series from southern Florida have been taken on roads and canal banks. Although it may be collected in this matter at almost any hour, most terrestrial movement seems to occur just at dusk. Some individuals were collected by dipping water hyacinths and other aquatic vegetation.

Kinosternon bauri palmarum is widespread in southern Florida, occurring in canals, ditches, sloughs, ponds, and larger bodies of fresh water on the mainland. On the upper keys it sometimes has been found in brackish water. Locality records for 155 specimens are:

Broward County: 1 mi. N Dade Co. line (1), 21.5 mi. W Ft. Lauderdale (1), 4.6 mi. S junction Ft. Lauderdale and Okeechobee-Miami roads (1), South New River Canal at Okeechobee-Miami Road (1). *Collier County*: 4-7 mi. W Carnestown (7), 10.8 mi. W Carnestown (1), Everglades (1), 2 mi. N Everglades (1), 8.2 mi. W Monroe Station (1), 12.6 mi. E Monroe Station (1), 19.6 mi. E Monroe Station (1), 1 mi. E Naples (1), Ochopee (8), 2.7 mi. W Ochopee (1), 8.2 mi. W Ochopee (1), 2.7 mi. ESE Royal Palm Hammock (1), 6-9 mi. ESE Royal Palm Hammock (3), 11-13.5 mi. ESE Royal Palm Hammock (3), Thickahatchee Swamp (1). *Dade County*: Biscayne Key (1), Coconut Grove (1), 4 mi. W Florida City (1), 4.2 mi. S Florida City (22), Homestead (4), Lee Hammock (1), Long Pine Key (4), 1 mi. N Medley (1), Miami (8), 7 mi. W, 2.5 mi. N Miami (2), 12 mi. W Miami (3), 13.5-17.5 mi. W Miami (3), 19 mi. W Miami (3), 19 mi. W, 3-6 mi. S Miami (2), 20-25 mi. W Miami (15), 27-30 mi. W Miami (7), 34-40 mi. W Miami (7), 2 mi. NW Miami (2), Paradise Key (8), 0.7 mi. E Paradise Key (3), 2.1 mi. E Paradise Key (1), 1.5 mi. SW Paradise Key (1), 5 mi. SW Paradise Key (1), 10 mi. SW Paradise Key (1), 17.4 mi. SW Paradise Key (1), Sweetwater (1). *Monroe County*: Key Vaca (1), Lower Matecumbe Key (3), Pinecrest (10), Upper Matecumbe Key (1).

Kinosternon subrubrum steindachneri Siebenrock

The carapace often has three faintly delineated pale longitudinal stripes, which are not so well developed as the similar stripes in *K. bauri*. The plastron may be uniformly black, uniformly yellow, or any intermediate condition between these extremes; most often it is horn-colored, with the newer growth showing as dark brown concentric rings surrounding the older, worn, yellowish or horn-colored central portions of each lamina. The head is mottled black and whitish; the upper beak is vertically striped whereas the lower beak is horizontally striped. Both sexes are approximately the same size.

The observed ranges and averages of measurements of five males and four females (all adult or subadult) from southern Florida are: carapace length 83.3 to 108.7 (92.8) mm., carapace width 56.2 to 73.8 (63.2) mm., plastral length 67.4 to 88.4 (75.3) mm., greatest depth 34.9 to 45.9 (38.7) mm. Examination of table 10 indicates that in the three ratios computed there is a tendency for specimens from southern Florida to average less in the ratio of width of bridge to carapace length, and to average more in the ratio of anterior lobe of plastron length to width of bridge. The material from southern Florida more closely resembles that from northern Florida in all ratios and most

measurements. In addition, all specimens from peninsular Florida are distinguishable from specimens from South Carolina on the basis of the shape of the posterior lobe of the plastron; the Florida specimens have a more or less triangular lobe (apex directed posteriorly), whereas in South Carolina specimens the posterior lobe is more quadrate or rectangular. In Florida specimens the greatest width of the posterior lobe occurs immediately posterior to the posterior lobe-median lobe suture; in Carolina specimens the greatest width lies near the midpoint of the free edge of the femoral laminae. Although the comparisons of northern and southern Florida specimens are based on inadequate samples for statistical analysis, in general the southern specimens seem to be somewhat smaller.

TABLE 10

MEANS OF MEASUREMENTS AND PROPORTIONS OF *Kinosternon subrubrum*
FROM THREE REGIONS.

	Southern Florida	Northern Florida	South Carolina
Males	5	2	2
Females	4	4	6
Carapace length	92.8	94.7	80.7
Carapace width	63.2	65.3	55.0
Plastron length	75.3	76.3	71.5
Greatest depth	38.7	40.3	34.8
Length of anterior lobe	27.9	30.5	27.7
Length of median lobe	20.1	20.2	17.5
Length of posterior lobe	27.4	29.7	26.0
Width of posterior lobe	32.3	35.1	33.7
Length of bridge	11.7	12.3	13.6
Width of head	24.9	23.4	18.8
Length of bridge/ Carapace length	.117	.129	.169
Length of anterior lobe/ Length of bridge	2.63	2.42	2.06
Carapace width/ Length of anterior lobe	2.26	2.28	1.97

This species is not so abundant in southern Florida as *K. bauri*; the two species occur in the same situations. Both have been collected crossing the Tamiami Trail, and all of our specimens from southern Florida have been taken in this manner. Carr (1940: 99) stated that the habitat of this turtle is "small streams, sloughs, and drainage ditches; marshes . . ."; we can add little to this since all

southern Florida specimens have been taken in the immediate vicinity of canals and other standing water.

Kinosternon subrubrum occurs throughout most of southern Florida; apparently it avoids the main part of the Everglades, an area where *K. bauri* reaches its greatest abundance. This species has not been recorded from the Florida Keys. A specimen was secured on Marco Island (which is completely separated from the mainland by salt water), and its occurrence there may indicate that *K. subrubrum* can survive in salt or brackish situations, although it does not usually occur in saline waters. There is a specimen (CM 26725) from Stock Island, near Key West, which has been identified as *K. subrubrum*. This individual cannot be located at this time, so that the identification cannot be verified. It may represent *K. subrubrum* (and if so, is the only known record of the species from the Florida Keys), but it may be assignable to *K. bauri*, which occurs on Stock Island and other Florida Keys. Locality records for 19 specimens are:

Collier County: Marco Island (1), Monroe Station (2), 7-10 mi. W Monroe Station (3), Naples (2), 7.4 mi. SE Naples (2), 5-6 mi. E Ochopee (4), Thickethatchee Swamp (1). *Dade County*: Miami (2), 30 mi. W Miami (1). *Monroe County*: Pinecrest (1).

Terrapene carolina bauri Taylor

Eight males exhibit the following ranges and means of measurements: carapace length 128 to 154 (140.1) mm., carapace width 85 to 104 (95.6) mm., greatest depth 68 to 78 (72.3) mm. Nine females: carapace length 109 to 142 (127.4) mm., carapace width 74 to 103 (88.7) mm., greatest depth 56 to 76 (68.1) mm. Three males from the keys have a flare on the posterior half of the carapace; also the carapace is proportionately wider than in mainland specimens. The carapace width/carapace length ratio for three males from the keys is 72.5; that for five males from the mainland is 65.6, and that for nine females from the mainland is 69.6. There are no females available from the keys. These data show that in the relatively wider carapace and presence of a flare posteriorly, the specimens from the keys resemble *Terrapene c. major*, thus supporting the evidence given by Auffenberg (1958). The smallest juvenile examined has a carapace length of 50 mm., a carapace width of 40 mm., and a greatest depth of 26 mm.

The series from southern Florida contains many immature individuals ranging in size from 70 to 100 mm. in carapace length. In comparing these with the large adults it is noted that there appears

to be a gradual darkening of the head pattern with age. Usually there are two longitudinal yellowish-brown, orange, or yellow stripes on top of the head. In a few specimens these are fragmented into a row of dashes or dots. In older specimens the stripes are darker, approaching a dull reddish brown or grayish yellow.

Terrapene reaches its greatest abundance in southern Florida in the rocky pineland between Miami and Florida City and in the region where the pineland gives way to the Everglades west of Miami. It does not inhabit the Everglades. On Marco Island and near Naples it was found in rosemary scrub, where it is associated with *Gopherus polyphemus*. The specimen from Key West was picked up in a vacant lot in 1954. It seems strange that with all of the available herpetological material from that island that the species had not previously been taken there. Since box turtles are often kept as pets, this particular individual may have been brought to the island from the mainland. Locality records for 69 specimens are:

Collier County: 2 mi. N Carnestown (1), 6.1 mi. S Deep Lake (1), Marco Island (1), 7.1 mi. N Jerome (1), 1.8 mi. SE, 1.9 mi. S Naples (1), 24 mi. SE Naples (1), 8.5 mi. NW Royal Palm Hammock (1). *Dade County*: 4 mi. S Florida City (2), 1.4 mi. W, 1.3 mi. S Florida City (1), 5 mi. SW Florida City (3), Homestead (2), 4.3 mi. W Homestead (1), 5 mi. W Homestead (1), 9 mi. N, 2 mi. W Homestead (2), 18 mi. N Homestead (1), 3 mi. W Kendall (1), Long Pine Key (8), Miami (4), 12-14 mi. W Miami (17), 15-19 mi. W Miami (3), Paradise Key (7), 2 mi. E Peters (1), 2.3 mi. N Richmond Air Base (1), South Miami (1), 2.2 mi. W Sweetwater (1). *Monroe County*: Big Pine Key (1), Key Largo (1), Key West (1), Pinecrest (1), Summerland Key (1).

Malaclemys terrapin macrospilota Hay

The geographical variation and definition of the southeastern subspecies of *Malaclemys terrapin* were presented by Schwartz (1955). Since his discussion no new material has become available; there are so few specimens of these highly variably turtles from southern Florida that the delimitation of ranges and the determination of variation is not possible at this time. Specimens of *M. t. macrospilota* from southern Florida are characterized by a dark carapace with distinct light centers in the central and lateral lamina. No males are known from southern Florida; four adult females range from 170 to 193 mm. in carapace length.

At Marco Island these turtles have been observed basking on logs during the day, and as many as six have been seen swimming in the mangrove-bordered canal. Johnson (1952) reported taking an

individual on the beach at Key Island, south of Naples, Collier County. During the period of deposition of eggs (June and July) females occasionally are encountered on roadways and canal banks; other than this periodic wandering, these turtles are confirmedly aquatic.

In southern Florida *M. t. macrospilota* is known only from the mangrove swamps and brackish canals of the Gulf coast as far south as Marco Island. One specimen of *macrospilota* purportedly from Key West (USNM 37021) is of questionable provenance (see Schwartz, 1955: 160). Locality records for 5 specimens are:

Collier County: Marco Island (4), 3.3 mi. SW Royal Palm Hammock (1).

Malaclemys terrapin rhizophorarum Fowler

This subspecies of *M. terrapin* is distinguished by the presence of black on the seams of the ventral surface of the marginals at the level of the bridge, no smudge on the marginals at the bridge, and head spots fused to form blotches. From the limited number of specimens available it appears that males are distinctly smaller than the females; the only male specimen has a carapace length of 117 mm., whereas a female from the same locality (Marquesas) has a carapace length of 172 mm.

Our attempts to collect specimens by trapping in mangrove swamps were futile, as were attempts to secure specimens from fishermen at Key West. Consequently, we have not encountered this form in southern Florida. Locality records indicate that the subspecies probably ranges throughout the chain of Florida Keys and possibly into the region of Florida Bay and the Ten Thousand Islands, where it may intergrade with *M. t. macrospilota*. Locality records for 3 specimens are:

Monroe County: Key Largo (1), Marquesas (2).

Malaclemys terrapin tequesta Schwartz

Malaclemys terrapin tequesta Schwartz, 1955, p. 158.

This subspecies has been adequately discussed and diagnosed by Schwartz (1955). No further specimens are available from southern Florida, so that the only known specimen from the area under consideration is the type. To define the southern range of this form additional material is needed from the lower reaches of Biscayne Bay and the extreme northern part of the Florida Keys. The single available specimen is from Miami Beach, Dade County.

Pseudemys floridana peninsularis Carr

Two adult females from Dade and Broward counties have the following measurements (in millimeters): carapace length 287 and 320, carapace width 205 and 222, plastron length 262 and 290, depth of shell 127 and 141, width of head 36 and 38, length of bridge 111 and 118; a small male from Collier County has these: carapace length 206, carapace width 147, plastron length 176, depth of shell 81, width of head 27, length of bridge 60.

Usually the carapace is dark brown to black with a complex yellow reticular pattern. The tomium of the upper jaw is noncusped and nonserrate, thus having a smooth appearance. This character will distinguish the species from *P. nelsoni*, which usually has a serrate and cusped upper tomium.

Pseudemys floridana is seldom encountered with the frequency of *P. nelsoni*, but certainly the former is more abundant than the few specimens indicate. They inhabit the canals and sloughs of the Everglades, but have not been observed in cypress ponds. Most frequently they are seen basking with *P. nelsoni* on mats of vegetation or rocks and partially submerged logs and branches. Both species are equally shy and cannot be approached.

The subspecies *P. f. peninsularis* occurs throughout the Everglades and adjoining fresh waters of southern Florida; there are no specimens available to us from the keys, although Carr (1935) reported the occurrence of this turtle on Key Largo. Locality records for 11 specimens are:

Broward County: No additional data (1). *Collier County*: 10 mi. N Cope-land (1), Royal Palm Hammock (1). *Dade County*: No additional data (4), 7 mi. W Medley (1), Paradise Key (3).

Pseudemys nelsoni Carr

Females attain a greater size than males; the following measurements of 11 adult females from southern Florida show the large size and variation: carapace length 251 to 320 (284) mm., carapace width 176 to 216 (198) mm., plastron length 234 to 294 (265) mm., depth of shell 108 to 139 (126) mm., length of bridge 96 to 124 (108) mm., width of head 34 to 42 (37) mm. Measurements, in millimeters, of two males from Dade County are: carapace length 229 and 170, carapace width 163 and 133, plastron length 209 and 163, depth of shell 94 and 76, length of bridge 81 and 66, width of head 31 and 26; a juvenile with a prominent umbilical scar from Collier County has

these: carapace length 32.4, carapace width 29.6, plastron length 28.9, depth of shell 16.8, length of bridge 9.7, width of head 9.0.

There is at hand an adult female turtle (ChM 54.144.19) which has been pronounced by John W. Crenshaw, Jr. a hybrid between *P. nelsoni* and *P. floridana peninsularis*. This specimen has a carapace length of 292 mm., and was taken 23 June 1954, 7 miles west of Medley, Dade County. This is one individual from a series of *P. nelsoni* and *P. floridana* collected at this locality by overtaking the turtles as they basked on a mud dam, before they could return to the water and escape. Twelve eggs were removed from this female in late June; they hatched on 10 September. This lot of 12 hatchlings has been studied by Crenshaw who concluded that they show the hybrid characteristics of the adult female.

Pseudemys nelsoni is a confirmed basker; large numbers can be seen during the summer on logs and rocks in the Tamiami Canal. That such basking activity is not confined to warmer months is demonstrated by basking as well as foraging individuals being seen in late December at Paradise Key. This species is an inhabitant of the canals and sloughs of southern Florida; it does not occur on the keys. Locality records for 40 specimens are:

Collier County: 5 mi. SE Naples (1). *Dade County*: 10.1 mi. NE Coot Bay Ranger Station (1), 7 mi. W Medley (9 *nelsoni*, 13 *floridana* × *nelsoni*), Miami (5), 11 mi. W Miami (1), 18-23 mi. W Miami (4), 30 mi. W Miami (1), 36 mi. W Miami (3), 2.6 mi. SW Paradise Key (1). *Monroe County*: 1.2 mi. E Pinecrest (1).

Deirochelys reticularia chrysea Schwartz

Deirochelys reticularia chrysea Schwartz, 1956a, p. 476.

Measurements for four males from southern Florida are: carapace length 110.2 to 144.0 (124.0) mm., carapace width 82.6 to 99.4 (85.8) mm., greatest depth 45.9 to 56.0 (49.7) mm. The same measurements for the single female examined are: 187, 126, and 82 mm. The variation in coloration in Florida and the differences between Floridian specimens and those from other parts of the range have been discussed at length by Schwartz (1956a).

Deirochelys is generally considered to be an inhabitant of ponds, and our meager data from southern Florida indicate that in this area it inhabits standing water or canals with a low gradient. It has been observed crossing the Tamiami Trail and occasionally basking on logs in the Tamiami Canal. Trapping in canals in southern Florida has yielded no specimens. Elsewhere it has been taken in cypress ponds, and probably it does not shun this habitat in southern Florida.

A female (185 mm. in carapace length) was encountered on 15 November 1952, near Monroe Station on the Tamiami Trail, at 1:30 p.m., while depositing eggs. The hole for egg deposition was cylindrical, approximately four inches deep and three inches in diameter at its mouth. One egg had been deposited at the time of the discovery of the turtle, and three additional ones were laid in captivity. The four eggs averaged 33.1 mm. in length, with an observed range of 32.0 to 34.1 mm. These are smaller than those reported by Carr (1952: 319), who stated that the eggs of this species vary between 37 and 40 mm. Carr likewise reported that the number of eggs per clutch may vary from 7 to 15, and that in Florida this species may deposit its eggs anytime of the year.

Deirochelys appears to be rare in southern Florida; doubtless its rarity is more apparent than real. It probably ranges throughout the Everglades; it does not occur on the keys. Locality records for 7 specimens are:

Broward County: New River (1). *Collier County*: 2 mi. N Copeland (1), 5.8 mi. E Monroe Station (1). *Dade County*: 5 mi. W Florida City (1), Long Pine Key (1), Miami (1), Tamiami Trail (1).

Gopherus polyphemus Daudin

Gopherus apparently is a rare turtle in southern Florida. A single adult female from the vicinity of Naples, Collier County, has a carapace length of 206 mm., carapace width 149 mm., greatest depth 88 mm., and plastron length (along midline) 185 mm.

In southern Florida the gopher turtle is confined to the sandy scrub areas that barely enter southern Florida in scattered patches in Broward and Dade counties on the east and along the Gulf coast as far south as Marco Island on the west. Although no specimens were secured, burrows belonging to this turtle were observed on Marco Island. Locality records for 3 specimens are:

Broward County: Hollywood (1). *Collier County*: 7.4 mi. N Naples (1). *Dade County*: Miami (1).

Chelonia mydas Linnaeus

The sea turtles have not been studied by us; however, we have attempted to compile locality records for existing specimens from southern Florida. These are included solely for the sake of completeness of the herpetological record for southern Florida. Five specimens of this species are available from Key West, Monroe County.

Eretmochelys imbricata Linnaeus

Locality records for 9 specimens are:

Southern Florida (1). *Monroe County*: Garden Key (Tortugas) (1), Key West (7).

Lepidochelys olivacea kempii Garman

One specimen is available from Sands Key, Dade County, and one from Key West, Monroe County.

Caretta caretta Linnaeus

Locality records for 23 specimens are:

Dade County: Governor Pass near Miami (1). *Monroe County*: "Florida Keys" (1), Key West (6), Long Key (2), Tortugas (13).

Trionyx ferox Schneider

Testudo ferox Schneider, 1783, Naturgeschichte Schildkröten, p. 330. Schwartz, 1956b, p. 1.

In adults the carapace is dull brown or blackish, and the skin is likewise dark in color. In juveniles, however, the dorsal pattern is made up of a series of bluish-black blotches on a dull brown background. The carapace is edged with orange, grading to yellow posteriorly. The plastron and ventral surface of the carapace are uniformly slate gray. Measurements of the largest female and the only male studied are: carapace length 321 and 183 mm., carapace width 231 and 140 mm., plastron length 194 and 116 mm., greatest depth 82 and 49 mm., length of bridge 38 and 20 mm., width of head 46 and 30 mm.

When specimens from southern Florida are compared with series from throughout the range of the species (Georgia, South Carolina, and northern and western Florida), little difference is observed between southern specimens and those from the rest of the range (see Schwartz, 1956b). Crenshaw and Hopkins (1955: 19) have noted that specimens of *T. ferox* from southern Florida (Lake Okeechobee southward) have a greater carapace width relative to head width. Color pattern and proportions are somewhat similar when specimens from southern Florida and South Carolina are compared.

Occasional individuals are observed basking. Often in preference to climbing on banks these turtles rest on beds of aquatic vegetation. They are always wary and quickly dive when approached. Adults and subadults are sometimes encountered on roads bordering canals;

adult females leave the water to deposit eggs and thus are readily collected. Although these turtles are omnivorous, traps baited with fish and beef have not taken them. They are often taken by fishermen on hooks baited with worms.

Trionyx occupies all fresh water habitats and has been noted in brackish water (Carr, 1952: 417) and even in marine situations (Carr, 1952; Neill, 1951a: 16). Although we have not taken specimens from cypress ponds, these turtles undoubtedly occur in that habitat. They are abundant in the Tamiami Canal and other artificial fresh-water canals. They are absent from the Florida Keys. Locality records for 15 specimens are:

Broward County: Birch State Park (1), Ft. Lauderdale (1), 22 mi. WNW, 6 mi. SSE Ft. Lauderdale (1). *Collier County*: 11.2 mi. E Monroe Station (1). *Dade County*: Miami (1), 15 mi. NW Miami (2), 19 mi. W Miami (2), 35 mi. W Miami (1), 42 mi. W Miami (1), 40 mi. W, 1.6 mi. NW Miami (1), Paradise Key (2), West Miami (1).

Dermochelys coriacea Linnaeus

Three specimens are available from Dade County—two from Biscayne Bay, one from Miami Beach.

Crocodylus acutus Cuvier

Moore (1953) has thoroughly reviewed the status of the crocodile in southern Florida. He has given the most comprehensive data on habits and life history of the species in Florida yet presented. Moore's data are in conflict with certain information presented by Carr (1940: 68-9). Carr stated that *Crocodylus* lives in fresh and salt water; apparently the species (as it now exists) is almost entirely restricted to brackish and salt-water habitats. We have observed it in brackish West Lake near Coot Bay Ranger Station in the Everglades National Park. Moore thinks that the abundance of *Alligator* in the fresh-water habitats may have restricted *Crocodylus* to those of salt water.

Dates for egg laying in captivity range from 12 March to 10 May; 21 to 56 eggs may be laid (Moore, 1953). He described the nest as a pile of sand lacking vegetation. Carr (1940) reported 15 to 20 young and an adult in a drainage ditch on Lower Matecumbe Key.

Although Carr recorded *Crocodylus* from Collier County, we have been unable to find any specimens from that area. Moore stated that he did not believe that the crocodile occurred on the lower west coast of Florida. Apparently the range is restricted to the brackish and marine habitats from Cape Sable eastward along the southern

coast of the peninsula, across Florida Bay and as far south as Big Pine Key. The Big Pine Key specimen was collected in 1953. The range, within recent years, extended northward along the east coast into Biscayne Bay. For locality records other than those given below, see Moore (1953). Locality records for 12 specimens are:

Dade County: Biscayne Bay (3), "Everglades" (5). *Monroe County*: Big Pine Key (1), Cape Sable (2), Key Largo (1).

Alligator mississippiensis Daudin

Our experience with this species in southern Florida has been limited to observations and sight records; none was collected. Since the alligator has been protected it seems to be increasing in numbers in the Everglades, and especially in the Everglades National Park. Individuals often find their way into small ponds in parks in Miami and Coral Gables. Numerous individuals have been observed from the road from Paradise Key to Flamingo, from the Loop Road, and from the Tamiami Trail. In the slough at Paradise Key as many as nine individuals have been seen at one time. In the sloughs and canals in the Everglades the alligator inhabits fresh water. Often small individuals are seen resting on mats of aquatic vegetation. Several individuals have been observed in the mangrove-bordered, brackish West Lake near Coot Bay Ranger Station in the Everglades National Park. Here they occur in the same habitat with *Crocodylus*.

The largest specimen observed was approximately 10 feet in total length; doubtlessly larger individuals exist in the more inaccessible regions of the Everglades.

Aside from the few locality records given below that are based on museum specimens, the many reports of this species in the literature show that it has a more extensive range in southern Florida. Fowler (1906) reported it from Little Pine and Summerland keys; Small (1923: 212) observed the species on Big Pine Key. Allen and Slatten (1945) reported the capture of three specimens at night in salt water at Key West. Locality records for 17 specimens are:

Collier County: 10 mi. N Everglades (2). *Dade County*: near Homestead (13), *Monroe County* (2).

Gonatodes fuscus Hallowell

Introduced into Key West sometime prior to April 1939, when the first specimens were collected (Carr, 1939), a colony of these geckos has thrived on the island ever since. In 1939 the species was abundant

in the old freight yards; today they are still found there, less commonly in the Navy Yards and in downtown Key West. The fact that numerous young individuals are seen indicates that the population is thriving.

The largest male examined has a snout-vent length of 40.3 mm. and an incomplete tail; another with a snout-vent length of 38.5 mm. has a tail length of 46.6 mm. The largest female has a snout-vent length of 37.8 mm. and a tail length of 30.5 mm.

Gonatodes fuscus is restricted to edificarian situations on Key West. Because of its habits it may be transported in the future to other cities, but it is unlikely that it will become established in natural habitats in southern Florida. Eleven specimens are available from Key West, Monroe County.

Hemidactylus turcicus turcicus Linnaeus

Fowler (1915: 252) reported *Hemidactylus mabouia* from Key West. This specimen, collected in March 1910, cannot be located to check its identity. Probably the specimen is an example of *Hemidactylus turcicus*, and, if so, stands as the first record for the species from Key West. Stejneger (1922) reported *H. turcicus* from Key West, the specimens having been collected in 1915 and 1921, and Barbour (1936: 113) recorded the species for the first time from Miami. We have found *Hemidactylus* to be abundant in Key West, but notably less so in Miami, there having been only five specimens collected in Miami in recent years. In the small cemetery in the middle of the city of Key West these lizards abound on stone walls, tombstones, and large urns. Numerous young have been collected, and clutches of eggs have been found in the bottoms of the urns.

The largest male has a snout-vent length of 55 mm., the largest female 53 mm. A juvenile has a snout-vent length of 23.6 mm.

From our experience with this species in Miami and Key West it is confined to edificarian situations. Two specimens (USNM 101148-149) from Big Pine Key may have been collected in the pine forest on that island. We have been unsuccessful in discovering this lizard in natural areas anywhere in southern Florida. Locality records for 88 specimens are:

Dade County: Miami (5). Monroe County: Big Pine Key (2), Key West (81).

Sphaerodactylus argus argus Gosse

Sphaerodactylus argus Gosse, 1850, Ann. Mag. Nat. Hist., ser. 6, vol. 2, p. 347.
Sphaerodactylus argus argus, Savage, 1954, p. 327.

A native of Jamaica, this species apparently was introduced into Cuba and Key West (Savage, 1954: 328). L. Neil Bell stated (*in litt.*) that of more than 150 specimens of *Sphaerodactylus* from Key West examined by him, none was identified as *S. argus*. The three specimens reported on by Savage (SU 10439-40, 10442) were collected in Key West by J. L. Grimmer and Earl S. Herald in February 1944. Recent collecting has shown no evidence of this species, and we assume that although it may have been introduced and established for a short period of time, no colony of *Sphaerodactylus argus* is extant on the island now.

Sphaerodactylus cinereus Wagler

Stejneger (1922) first reported this lizard from Key West, one specimen having been collected there in 1921. Burt (1937: 352) recorded a specimen from Key Largo, collected in 1928. This specimen (USNM 75113), although dried, can be identified as *Sphaerodactylus notatus*. The main colony of these lizards is in Key West; however, in 1954, a single specimen was secured on Boca Chica Key, two islands removed from Key West and connected with it by a causeway.

On Key West the lizards are found commonly in the old cemetery and on buildings in town. They are secretive and wary, and because of their small size are difficult to capture. The largest male has a snout-vent length of 33.5 mm., the largest female, 35 mm. Numerous brightly banded juveniles with brick red tails were observed in the cemetery. The smallest one collected has a snout-vent length of 16.5 mm.

Like the preceding species of geckos, all introduced into southern Florida in relatively recent years, *S. cinereus* is an inhabitant of buildings in cities; none has been found in natural areas. Of 78 available specimens, one is from Boca Chica Key, and the remainder from Key West, Monroe County.

Sphaerodactylus notatus Baird

The pigmentation of this small gecko is quite variable, and there is a distinct difference in coloration between the sexes. In males the entire dorsal surface of the body is spotted with dark punctations, each of which consists of a single darkened scale. There is no tendency for the head spots to be arranged in either transverse or longitudinal rows or to form stripes. The gular region is strongly pigmented with dark spots. The preanal patch of thickened scales is

well defined. Females have three longitudinal dark stripes on the head, one median and two postocular. The centers of these stripes are lighter than the borders; this is especially true of the median stripe. Posterior to the scapular region the dorsum has the same dark punctations as in the males. Smith (1946: 75) mentioned specimens that were intermediate between these patterns as well as unicolor individuals. The latter are old males in which all traces of the spots have been lost. By utilizing the large series of available specimens, so-called intermediate specimens may be placed with ease. Males always have spotted heads; in females, the dark lines or rows of spots or dashes, perhaps ill-defined, are always present.

The largest specimen examined had a total length of 30.5 mm.; the smallest sexually mature individual was 20.5 mm. long.

Sphaerodactylus notatus has been collected in pineland, hammocks, cypress heads, vacant city lots, in deserted houses, and in inhabited wooden buildings. It is abundant at Matheson Hammock, Paradise Key, Key Largo, and Key West. Apparently the species is primarily diurnal, although occasional individuals have been observed at night.

The breeding habits of *S. notatus* have received little mention in the literature. Mittleman (1950) reported an egg in a specimen presumably collected on 6 May 1948. The egg measured 3 by 5.5 mm. Carr (1940: 71) stated: "The eggs are laid from June to August, singularly or by twos or threes. . . ." On 29 December 1951, seven *S. notatus* eggs were found at Key West; the average size was 4 by 6 mm. Five of these eggs hatched in 74 days, the other two required 79 days. On 8 March 1952, a large composite nest containing 280 eggs was found in a termite-ridden log at Key West. These eggs had an average size of 4.3 by 5.8 mm. and hatched over a period of two months. The eggs are hard, oval, and with a brittle shell. Dissection of gravid females indicates that only one egg matures at a time. It is probable that a single female deposits several eggs each year, but whether breeding occurs more than once a year is problematical. Egg laying, as demonstrated by the large number found in one log, is often communal; a single egg is rarely found. Eggs have been found in a variety of sites, including bases of palm fronds, termite-ridden log, driftwood, leaf debris, rotting logs, beneath stones, in piles of boards, coconut husks, walls of a deserted cistern, and beneath tar paper on roofs of houses.

Examination of stomach contents has revealed the following food items: Coleoptera (Carabidae, Chrysomelidae, Curculionidae, Hydrophilidae, Scarabaeidae, Scolytidae, Staphylinidae), Hymenoptera (Formicidae), Hemiptera, lepidopteran larvae, and one annelid.

Sphaerodactylus notatus occurs along the entire string of Florida Keys, along the east coast of the mainland as far north as Ft. Lauderdale, on Cape Sable, and as far inland as Paradise Key. The species was described in 1858 from Key West. Specimens were first collected in Miami in 1916 (Fowler, 1917); Barbour (1921: 277) listed the species from Key West, Miami, Royal Palm Hammock (= Paradise Key), Big Pine Key, and Upper Matecumbe Key. It is worthy of note that *S. notatus*, a supposedly introduced form, occupies a wide range in southern Florida. Upon comparing the ranges of *S. cinereus* and *notatus* it is obvious that the latter either has been in Florida for a much longer time and thus had sufficient time to disperse, or that it is far better adapted for the available habitats. Where the two species are found together, both are abundant. This plus the wide distribution of *S. notatus* as compared with the limited one of *cinereus* in southern Florida lends support to the contention that *S. notatus* has inhabited southern Florida for a considerable length of time and that its "introduction" probably was a natural one and not due to the agency of man. Locality records for 176 specimens are:

Broward County: Birch State Park (3), Ft. Lauderdale (2). *Dade County*: Elliott Key (6), Lemon City (2), Long Pine Key (1), Matheson Hammock (2), Miami (4), Miami Beach (1), Paradise Key (11), 4.1 mi. SW Paradise Key (1). *Monroe County*: Big Pine Key (7), Cudjoe Key (1), Flamingo (1), Key Largo (13), Key West (91), Lignumvitae Key (4), Little Torch Key (2), Lower Matecumbe Key (1), Matecumbe Key (4), Plantation Key (1), Stock Island (5), Sugarloaf Key (3), Summerland Key (2), Teatable Key (1), Tortugas (1), Upper Matecumbe Key (6).

Anolis carolinensis carolinensis Voigt

In southern Florida *Anolis carolinensis* is highly variable in scutellation, proportions, and coloration. From northern specimens (northern Florida to South Carolina) individuals from southern Florida may be distinguished immediately by their smaller size and less massive heads. For convenience in comparison of specimens from different areas in southern Florida, specimens are grouped as follows: lower keys, upper keys, eastern mainland (the eastern rock rim from Ft. Lauderdale to Homestead), and western Collier County (west of the Everglades). The following characters are found to vary from one area to another: color of throat fan in life, presence or absence of striping on the throat, relative size of ventral scales to dorsals, degree of keeling of dorsal head scales anterior to the orbit, and head width/snout-vent length ratio. For each of these characters 15 males from each area were examined, with the exception of western Collier County from where only seven males are available. Brief diagnoses of these samples are:

Lower keys.—Throat fan pink to red; no stripes on throat, but sometimes indistinctly spotted; head scales strongly keeled; head width greater than 17 percent of snout-vent length; ventrals slightly larger than dorsals.

Upper keys.—Throat fan red; numerous longitudinal brown stripes on throat; ventrals and dorsals essentially similar in size; head scales strongly keeled; head width less than 17 percent of snout-vent length (average ratio 15.8%).

Eastern mainland.—Throat fan red; throat without stripes, but sometimes with series of dashes or spots in longitudinal rows; ventrals half again the size of dorsals; head scales moderately to heavily keeled; average head width/snout-vent length ratio 16.2 percent.

Western Collier County.—Throat fan pale greenish gray or greenish white; no stripes on throat; ventrals slightly larger than dorsals; head scales moderately keeled; head width/snout-vent length ratio 16 to 18 percent (16.8%).

One specimen from 2 miles north of Deep Lake, Collier County, presents a striking array of characters that sets it off from all other specimens from southern Florida. It is a male with a snout-vent length of 55 mm. The ground color is pale grayish tan, and there is a pair of lateral and a pair of dorsolateral dark brown stripes; behind the eye and extending to the angle of the jaws is a dark brown patch. The dorsal head scales anterior to the orbit and median to the canthal ridges are smooth. The ventral scales are subequal in size to the dorsals; the head width is 16.2 percent of the snout-vent length.

Individuals from western Dade County and eastern Collier County apparently represent either a mixed or intermediate population between that to the west, the members of which have greenish throat fans, and that to the east with red throat fans. Individuals with light throat fans have been encountered farther north on the west coast at Sarasota and Englewood.

That such variation in these characters can be found in such a relatively small part of the range of *Anolis carolinensis* leads us to believe that either the species is highly variable throughout its range, breaking up into populations showing minor color and morphological differences, or that the populations in southern Florida have become altered through the introduction of individuals from various insular populations. Perhaps both are true; however, the most distinctive population is that in western Collier County, the area least likely to receive imports from overseas.

Ten males from Miami have snout-vent lengths from 55 to 58 (56.6) mm. and tail lengths from 105 to 128 (113.6) mm.; ten females

have snout-vent lengths from 42 to 52 (46.4) mm. and tail lengths from 85 to 112 (94.4) mm.

Anoles are abundant throughout the keys and most of southern Florida with the exception of the Everglades where they occur sporadically. The optimum habitat appears to be in mesophytic hammocks; this type of habitat often is artificially represented in gardens and shrubbery around houses, and in such places anoles are abundant. Many individuals have been found at night sleeping on reeds and grasses. Locality records for 233 specimens are:

Broward County: Birch State Park (2), Ft. Lauderdale (1). *Collier County*: Deep Lake (3), 2 mi. N Deep Lake (1), Everglades (1), Key Island (1), Marco Island (1), 8.6 mi. E Monroe Station (1), Naples (2), 3-5 mi. SE Naples (6), 11 mi. SE Naples (2), Ochopee (2), Tamiami Trail (1). *Dade County*: Cape Sable Road (5), Coconut Grove (1), Coral Gables (6), 5 mi. S Coral Gables (5), Elliott Key (2), Florida City (2), Homestead (1), Lee Hammock (1), Lemon City (1), Matheson Hammock (4), Miami (21), Miami Beach (3), Paradise Key (10), 5 mi. SW Paradise Key (3), 6.5 mi. SW Paradise Key (1), 20 mi. SW Paradise Key (3), Tamiami Trail (1). *Monroe County*: Big Pine Key (12), Boca Chica Key (3), Cape Sable (1), Coot Bay (1), Cudjoe Key (3), Flamingo (3), Indian Key (2), Key Largo (15), Key West (60), Lignumvitae Key (1), Little Torch Key (1), Long Key (1), Lower Matecumbe Key (5), 6.1 mi. S, 6.4 mi. E Monroe Station (2), New Found Harbor Keys (3), Pinecrest (8), Plantation Key (4), Ragged Key (1), Sandy Key (2), Stock Island (3), Sugarloaf Key (1), Summerland Key (1), Totten's Key (1), Upper Matecumbe Key (5).

Anolis distichus distichus Cope

Anolis distichus Cope, 1861, Proc. Acad. Nat. Sci. Philadelphia, vol. 13, p. 208.
Anolis distichus floridanus Smith and McCauley, 1948, p. 160.

The first specimens of this lizard collected in Florida were taken by R. H. McCauley at Brickell Park in Miami in 1946; subsequently, Smith and McCauley (1948: 160) described the Florida specimens as a race distinct from those occurring in the Bahamas. Critical examination of the large series now available from southern Florida provides data that are at variance with those presented by Smith and McCauley, who state that *floridanus* differs from *distichus* by having the supraorbital semicircles always separated along the midline; by generally having two scales separating the prefrontal from the anterior superciliary, and by having the throat and chest heavily pigmented. An analysis of these characters and certain others (number of infraorbitals and number of scales bordering median suture) based on 222 specimens from southern Florida and the Bahamas shows that the only character that separates part of the population in Florida from those in the Bahamas is the separation of the circumorbital semicircles (table 11). Since no other characters separate the Florida

specimen from those from the various Bahaman Islands on which *Anolis d. distichus* occurs, the Florida specimens should be considered as examples of the race *distichus*, and the name *Anolis d. floridanus* Smith and McCauley should be considered a synonym of *Anolis distichus distichus* Cope.

TABLE 11

VARIATION IN *Anolis distichus* FROM SOUTHERN FLORIDA AND THE BAHAMA ISLANDS.

	Florida	New Providence	Andros	Eleuthera
Number of specimens	77	57	58	30
Circumorbital semicircles:				
Separated	49 (63.6%)	8 (14.0%)	29 (50.0%)	10 (33.3%)
In contact	28 (36.4%)	49 (86.0%)	29 (50.0%)	20 (66.7%)
Number of scales separating prefrontal from anterior superciliary	<div> <div>1</div> <div>39 (50.6%)</div> </div> <div> <div>2</div> <div>38 (49.4%)</div> </div> <div> <div>3</div> <div>0 (0.0%)</div> </div>	<div>21 (36.8%)</div> <div>36 (63.2%)</div> <div>0 (0.0%)</div>	<div>17 (29.3%)</div> <div>38 (65.5%)</div> <div>3 (5.2%)</div>	<div>10 (33.3%)</div> <div>20 (66.7%)</div> <div>0 (0.0%)</div>
Number of infraorbitals	7-10 (8.1)	7-9 (8.0)	7-11 (9.0)	7-10 (8.6)
Number of scales bordering median suture	4-7 (5.2)	4-7 (4.9)	4-7 (5.9)	4-6 (5.1)
Throat:				
Pigmented	35 (45.4%)	24 (42.1%)	24 (41.4%)	23 (76.6%)
Unpigmented	42 (54.6%)	33 (57.9%)	34 (58.6%)	7 (23.4%)

The specimens from Andros Island (table 11) are topotypic *Anolis distichus distichoides* Rosén. Supposedly this race differs from the nominal subspecies in that it has a greater number of infraorbitals and a greater number of scales bordering the median suture. These differences are slight, and with the examination of large series from other islands, such subspecific designation may be seen to be unwarranted. However, a review of the *Anolis distichus* complex is beyond the scope of the present report.

Ten large males from Miami have snout-vent lengths from 45 to 49 (47.4) mm. and tail lengths from 65 to 69 (66.3) mm.; ten females have snout-vent lengths from 45 to 47 (45.8) mm. and tail lengths from 61 to 63 (62.4) mm. The smallest juvenile examined has a snout-vent length of 24 mm.

At Brickell Park and Fairchild Gardens where this lizard is abundant, individuals are found on the trunks of trees, usually fig trees, but often palms. The light gray color of the lizard blends well with the color of the bark. When approached the lizards run up the trees out of reach or out of sight among the leaves. Individuals

seldom were seen on the ground, and then always at the base of a tree.

This introduced form is found only in the environs of Miami. Locality records for 85 specimens are:

Dade County: Brickell Park, Miami (51), south of Miami River on Brickell Avenue, Miami (7), Fairchild Gardens, 5 mi. S Coral Gables (27).

Anolis sagrei stejnegeri Barbour

The specific and subspecific status of the Floridian populations of *Anolis sagrei* has been questioned and altered by several workers. Barbour (1931a) described the lizards from Key West as a distinct species, *stejnegeri*. Oliver (1948), in discussing the variation and relationships of *Anolis sagrei*, included *stejnegeri* as a subspecies. Bell (1953) reported *A. sagrei ordinatus* from Miami. The Miami population apparently started from a rather recent introduction by man. Oliver (1948: 24) gave six characters that distinguish the subspecies *ordinatus*, *sagrei*, and *stejnegeri*: nature of the circumorbital semicircle series, color of the throat fan, prominence of the caudal crest, nature of the lateral body scales, color of the midventral scales at the anterior end of the throat fan, and over-all coloration. An analysis of these characters has been made for 263 specimens of *Anolis sagrei*, as follows: Florida.—Miami (34), Cudjoe Key (5), Key West (54); Cuba (22); Yucatán (10); Bahamas.—Andros (47), Bimini (22), Eleuthera (37), Exumas (32). The nature of the circumorbital semicircle series differs as to the number of small scales separating the semicircles in the midline (one or two rows), or, if the semicircle series are in contact, whether one or two pairs of scales are in contact. In this respect Cuban and Floridian specimens appear close, whereas those from Exuma and Bimini are characterized by nearly all individuals having one or two pairs of scales in contact; the Andros and Eleuthera specimens are intermediate (table 12). Preserved specimens from Florida have a red-orange throat fan; individuals from Yucatán, Bahamas, and Cuba have a grayish-brown throat fan. The throat fan in living individuals from Cuba is orange. The caudal crest is most prominent in individuals from Cuba and Yucatán, slightly less so in Bahaman specimens, and least prominent in Floridian ones. The lateral body scales are minute and granular in Bahaman specimens and slightly larger in individuals from Cuba and Yucatán. Those from Florida have much larger lateral scales that are either keeled on the posterior margin or tuberculate and slightly imbricate. The midventral throat scales of the Floridian specimens are light, not black or dark gray as

in individuals from the Bahamas, Cuba, and Yucatán. Although it is difficult to determine in preserved specimens, the dorsal ground color of the Floridian specimens appears lighter than that of the others. Specimens from Florida usually are light grayish tan; however, since in life the intensity of the pigmentation varies considerably, this character should receive little emphasis.

TABLE 12

VARIATION IN THE CONDITION OF THE SUPRAORBITAL SEMICIRCLE SERIES OF 263 *Anolis sagrei*. NUMBERS IN PARENTHESES ARE PERCENTAGES.

Locality	Number of specimens	Semicircles separated by two scales	Semicircles separated by one scale	One pair of scales in contact	Two pairs of scales in contact
Miami	34	10 (29.4)	24 (70.6)	0 (0.0)	0 (0.0)
Cudjoe Key	5	3 (60.0)	2 (40.0)	0 (0.0)	0 (0.0)
Key West	54	5 (9.3)	47 (87.0)	2 (3.7)	0 (0.0)
Cuba	22	1 (4.5)	21 (95.5)	0 (0.0)	0 (0.0)
Yucatán	10	0 (0.0)	9 (90.0)	1 (10.0)	0 (0.0)
Andros	47	0 (0.0)	20 (42.6)	27 (54.6)	0 (0.0)
Eleuthera	37	1 (2.7)	22 (59.4)	14 (37.9)	0 (0.0)
Exumas	32	0 (0.0)	5 (15.6)	20 (62.5)	7 (21.9)
Bimini	22	0 (0.0)	0 (0.0)	17 (77.3)	5 (22.7)

On the basis of this analysis Floridian specimens may be distinguished from all others by the larger lateral scales, the light throat, the lower caudal crest, the color of the throat fan, and the lighter dorsal ground color. On the basis of the nature of the circumorbital semicircle series, and less so on the nature of the lateral body scales, the Floridian and Cuban populations appear to be more closely related than either is to those in the Bahamas. Further studies of the Bahaman populations may reveal the presence of two or more races inhabiting those islands. Yucatán specimens are similar to those from Cuba. Consequently, we concur with Oliver (1948) in placing *Anolis stejnegeri* as a recognizable subspecies of *Anolis sagrei*, and consider it most closely related to *A. s. sagrei* in Cuba.

The status of the Miami population of *Anolis sagrei* is questionable; from the above analysis of characters the individuals from Miami appear to be much closer to specimens from Key West (*stejnegeri*) than to *ordinatus* in the Bahamas. The Miami specimens have the large lateral scales and a red throat fan; none has the circumorbital scales in contact. A few individuals show some dark pigment in the throat

region. Possibly, this population originally was derived from that on Key West and later was influenced by the introduction of *ordinatus* from the Bahamas, the latter form now having been absorbed into the *stejnegeri* population but not without altering the original population slightly. Therefore, we consider the Miami and Key West populations to represent one form, namely *A. sagrei stejnegeri*.

Twenty males from Key West have snout-vent lengths from 49 to 60 (53.9) mm. and tail lengths from 92 to 117 (101.4) mm.; 20 females have snout-vent lengths from 40 to 44 (42.4) mm. and tail lengths from 73 to 76.5 (75.0) mm.

Anolis sagrei is abundant in Key West; individuals usually are seen on the ground, on rocks, or on walls; seldom are they seen in trees or bushes. A mating pair was noted on Key West on 13 August 1954. A captive pair mated in a large terrarium on 13 July 1954. The male faced the female on a large piece of bark; he bobbed his head and extended the throat fan. She responded with head bobbing. This action continued for approximately two minutes when the male moved to the right side of the female; he crawled along her side until his head was at the level of her neck. He then grasped the back of her neck in his jaws and moved his body on top of hers but moved the tail under hers so that the cloacae were in contact. The time that lapsed in gaining this position was about one minute. Copulation began with vigorous pumping action of the posterior part of the male's body, action which lasted for about 30 seconds. The position was retained for about three minutes, after which they disengaged and moved about three inches apart, each individual bobbing the head for about a minute. All the time the male held the female in his jaws she remained quiet.

During the summer of 1954 several eggs were deposited in a terrarium; one laid on 14 July hatched on 29 August. The hatchling had a snout-vent length of 16.0 mm. and a tail length of 28.0 mm. Four hatchlings collected in Miami on 12 and 25 June 1953, had large umbilical scars and snout-vent lengths from 15.0 to 18.0 (16.5) mm. and tail lengths from 24.5 to 29.0 (27.8) mm.

In the graveyard in the middle of Key West observations were made on territoriality in this species. Males had certain "lookout posts" to which they would always return after they had been frightened away by our approach. On some of the low stone walls several males could be observed, each within three or four feet of the nearest neighbor, but never much closer. Apparently each male had a certain section of the wall which he defended. Females showed no signs

of territoriality and were permitted to pass through the territories of the males.

In Miami and Key West this species lives for the most part in edificarian situations; however, on Cudjoe Key it was found inhabiting a sandy area with piles of brush and old logs. Locality records for 253 specimens are:

Dade County: Coral Gables (3), Miami (61). *Monroe County*: Cudjoe Key (5), Key West (184).

Leiocephalus carinatus virescens Stejneger

Apparently introduced into Miami in 1935 (Barbour, 1936), this species has not been observed there for 13 years. Carr (1940: 72) mentioned that two had been seen "recently" in a pet shop in Miami and that these had been captured in the city. Raymond Porter stated (*in litt.*) that they used to be seen occasionally near the blimp base in Miami, but that he has seen none since 1945. During the course of our field work in southern Florida we inquired about this lizard, but all collectors and local amateurs replied that they had not seen any. Consequently, it appears that with the growth of the city *Leiocephalus* has been exterminated.

Sceloporus woodi Stejneger

Two males from Naples, Collier County, have snout-vent lengths of 50 and 56 mm.; both have broken or regenerated tails. Ten females have snout-vent lengths from 50 to 55 (52.6) mm. and tail lengths from 80 to 89 (84.4) mm. The smallest juvenile examined has a snout-vent length of 27.0 mm. and a tail length of 41.5 mm. The males have dark blue belly patches edged medially with black. The throat is blue, turning black medially; however, the midventral part of the throat is white. Females have pale blue belly patches and throat blotches; there is no black in the ventral coloration.

In the rosemary scrub and *Pinus clausa* association in western Collier County as far south as Marco Island, this lizard is abundant. It also occurs in the small, scattered patches of rosemary scrub in eastern Broward and northeastern Dade counties. This is a cursorial species, running over the sandy soil in much the same manner as *Cnemidophorus*. Individuals were observed to take shelter in burrows and in the tangled exposed roots of the rosemary bushes. So far as we have been able to discover, in southern Florida this lizard is found only in areas of sandy soil and rosemary scrub; consequently,

its range in southern Florida is rather restricted. It does not occur on the keys. Locality records for 59 specimens are:

Broward County: 1 mi. N Hallandale (14). *Collier County*: Marco Island (10), Naples (19), 4 mi. SE Naples (7), 7.4 mi. N Naples (3). *Dade County*: Miami (6).

Ophisaurus attenuatus longicaudus McConkey

Two specimens (UF 3554) are from the western part of Miami, apparently taken in the dry grassy prairie regions there. Both have the dark stripes on the venter characteristic of *attenuatus*; they have 103 and 109 scales along the lateral fold, and both have a single fronto-nasal. One with a complete tail has a body length of 143 mm., tail length of 358 mm., and a tail/body ratio of 2.50.

McConkey (1954: 154) gave the range of this form as extending southward to Brevard County in eastern Florida and to Charlotte County on the Gulf coast. The present record extends the range about 135 miles south along the Atlantic coast. Two specimens are available, both from Miami, Dade County.

Ophisaurus compressus Cope

Twenty-six specimens have from 83 to 92 (87.2) scales along the lateral fold; all but one have a divided frontonasal. Adults vary from 157 to 190 mm. in body length and from 470 to 508 mm. in tail length. The tail/body ratio varies from 2.76 to 3.16 (2.93). This is notably higher than that given for the entire species by McConkey (1954: 162).

This is the most abundant form of *Ophisaurus* in southern Florida. It inhabits the pineland and scrub areas as well as the pineland-Everglades ecotone. During times of high water these lizards are forced to higher ground, such as dams and roadbeds where they are caught with ease. During the summer of 1954, numerous specimens were encountered in the high grass along the roadway north of Homestead. Babbitt and Babbitt (1951) reported seeing 33 living and 24 dead *Ophisaurus* "in a space of 100 feet" after a fire located about 6 miles west of Miami. Their observations probably were based on *compressus*.

In southern Florida *Ophisaurus compressus* occurs east of the Everglades to the tip of the peninsula; west of the Everglades it is uncommon, having only been found in the pineland and mixed pine and cypress associations as far south as the town of Everglades. Locality records for 34 specimens are:

Collier County: Everglades (1), 7 mi. N Jerome (1). *Dade County*: Coral Gables (2), 4 mi. E Goulds (1), Homestead (1), 12-15 mi. N Homestead (12), 1 mi. W Kendall (1), Lemon City (1), Long Pine Key (2), Miami (4), 14 mi. W, 2 mi. S Miami (1), 19 mi. W, 7 mi. S Miami (2), Ojus (1), Paradise Key (2). *Monroe County*: Coot Bay Ranger Station (1), Flamingo (1).

Ophisaurus ventralis Linnaeus

Seven specimens have from 98 to 110 (103.6) scales along the lateral fold; all have a single frontonasal. Three large adults have body lengths of 198, 215, and 218 mm. None has a complete tail. Smaller individuals with complete tails have a tail/body ratio from 2.00 to 2.02. No juveniles are at hand.

In the eastern part of the area *O. ventralis* appears to be rare; it is more abundant west of the Everglades, but even there it is not so abundant as *O. compressus* is between Miami and Homestead. Most individuals have been collected in dry grassland or in pineland. The status of *Ophisaurus* on the Florida Keys is questionable; the specimen from Key West was collected by Hebard (see discussion under *Limnoaedes ocularis*). We have collected no specimens on the keys. Locality records for 16 specimens are:

Broward County: 16 mi. W, 1.6 mi. S Ft. Lauderdale (1). *Collier County*: 4 mi. N Jerome (1), 1 mi. W Monroe Station (1), 1.7 mi. SE Naples (1), 2.1 mi. SE Naples (1), Paolita Station (1). *Dade County*: Lemon City (3), Miami (3). *Monroe County*: Indian Key (2), ?Key West (1), 6 mi. S, 6 mi. E Monroe Station (1).

Ameiva ameiva subsp.

In April 1954, a colony of large teiid lizards was discovered in an area of overgrown vacant lots near the junction of 34th Avenue and 79th Street, Northwest, in Miami. A large adult male (UMRC 54-345) was collected by Stan Kaplan. It has a snout-vent length of 160 mm. and a tail length of 375 mm. On 22 June 1954, we visited the locality and collected one hatchling with an open umbilicus; it had a snout-vent length of 50 mm. and a tail length of 97 mm. Numerous adults, some larger than the original one, were observed. These were extremely wary, and at no time did we get closer than 50 feet to one. Several other juveniles were observed.

In all respects these lizards are *Ameiva ameiva*, and in most respects they resemble the subspecies *petersi*. Definite assignment cannot be made at this time.

The locality where these lizards are found is adjacent to a building that had been occupied by an animal dealer and importer. In

all probability these individuals either escaped from that establishment, or were released by the dealer. The presence of hatchlings indicates that the colony is reproducing and that it may flourish. They were observed again in May 1955. Two individuals are available from Miami, Dade County.

Cnemidophorus sexlineatus sexlineatus Linnaeus

Lacerta sexlineata Linnaeus, 1766, Systema Naturae, ed. 12, vol. 1, p. 364.

Twenty adults from the lower keys have snout-vent lengths from 58 to 72 (66.5) mm. and tail lengths from 150 to 159 (154.5) mm. The only character examined that shows geographical variation in the Florida peninsula is the number of femoral pores (table 13). The number is lowest in the southern part of the peninsula and highest on the lower keys and in the northern part of the peninsula.

TABLE 13

MEAN FEMORAL PORE COUNTS OF *Cnemidophorus sexlineatus* IN PENINSULAR FLORIDA AND THE FLORIDA KEYS. (LOCALITIES ARRANGED FROM NORTH TO SOUTH.)

Locality	Number of specimens	Number of femoral pores
Lake County	26	33.5
East coast north of Miami	5	33.5
Miami	7	29.2
Key Largo	10	29.7
Lower Matecumbe Key	13	32.8
Big Pine Key	7	32.1
Sugarloaf Key	13	30.6

Burt (1931: 83) stated that specimens from the southern tip of the peninsula appear to have a darker ground color than northern specimens, and that the middorsal light streak often is constricted, exhibiting more of the ground color between the paravertebral light stripes. This is true for a number of specimens from southern Florida and from the keys, but the darker ground color and constricted middorsal stripe are not consistent, there being as many individuals with the "normal" coloration as there are with the darker color pattern.

This species is an inhabitant of open, dry situations like sandy pineland, rosemary scrub, coastal beaches, and cleared forest. In southern Florida it occurs on the east coast ridge, in the sandy pine-

land and rosemary scrub west of the Everglades, and along the chain of the Florida Keys. Locality records for 163 specimens are:

Broward County: Birch State Park (1), 6 mi. W Ft. Lauderdale (4), Hallandale (1). *Collier County*: Key Island (1), Marco Island (4), 1 mi. E Naples (1), 3 mi. SE Naples (12), 4.5 mi. SE Naples (7), 7.4 mi. SE Naples (2). *Dade County*: Coconut Grove (2), Coral Gables (3), 6 mi. S Homestead (2), Lemon City (1), Matheson Hammock (1), Miami (7). *Monroe County*: Big Pine Key (13), Boca Chica Key (2), Key Largo (12), Key West (43), Little Torch Key (1), Lower Matecumbe Key (14), New Found Harbor Keys (2), Stock Island (3), Sugarloaf Key (16), Upper Matecumbe Key (8).

Lygosoma laterale Say

The largest specimen examined from southern Florida is a female with a snout-vent length of 46.0 mm. Ten males from Key West have snout-vent lengths from 36.0 to 40.5 (38.7) mm. and tail lengths from 62 to 71 (66.7) mm.; seven females have snout-vent lengths from 33.0 to 46.0 (39.7) mm. and tail lengths from 55.0 to 59.0 (57.4) mm. (the largest female had a regenerated tail).

Specimens from the mainland of southern Florida and from the upper keys have dark flanks flecked with white; there is no light stripe above the dorsolateral dark stripe. Individuals from the lower keys have dark streaks or fine longitudinal lines on the flanks; the dark stripe is not bordered above by a light one. cursory examination of specimens from Silver Springs and from Tallahassee, Florida, shows that those from Silver Springs have dark streaks similar to those on specimens from Key West; this is also true for the Tallahassee specimens, but these have a fine light stripe above the dorsolateral dark stripe. M. B. Mittleman, who has been studying the geographical variation in this species, stated (*in litt.*) that he considered the northern Florida population to be closer in most characters to the population on the lower keys than to that in southern peninsular Florida. Mittleman is now engaged in studying the taxonomic relationships of these populations.

Lygosoma is an inhabitant of hammocks and pine forest. In hammocks where there is a wealth of debris and leaf litter for cover, these lizards are especially abundant. The species occurs on the eastern rim of southern Florida, in the western forests, and throughout the keys. Locality records for 110 specimens are:

Collier County: Everglades (1), Goodland Point, near Marco (1), 1 mi. W Monroe Station (1), 4.2 mi. S Monroe Station (4), Naples (2), 3 mi. SE Naples (3), Royal Palm Hammock (1). *Dade County*: "Everglades" (1), Lemon City (2), Miami (4), Paradise Key (1). *Monroe County*: Big Pine Key (6), Boca Chica Key (3), Cape

Sable (1), Cudjoe Key (2), Indian Key (1), Key West (49), Lignumvitae Key (3), Long Key (2), Lower Matecumbe Key (11), Matecumbe Key (2), Stock Island (5), Sugarloaf Key (1), Summerland Key (2), Upper Matecumbe Key (1).

Eumeces egregius egregius Baird

Specimens from the Florida Keys, and the lower keys in particular, have the dorsolateral light stripes extending the length of the body and have the two middorsal scale rows enlarged. In this respect they resemble individuals from extreme northeastern Florida and southern Georgia, an area inhabited by *Eumeces egregius similis* (McConkey, 1957). It is worth noting that these populations more closely resemble one another than either does the population in the southern part of the peninsula. Individuals from the upper keys have characteristics intermediate between typical *egregius* on the lower keys and *onocrepis* on the mainland. Two specimens from Upper Matecumbe Key have short dorsolateral stripes that extend for about one third the length of the body. The median dorsal scale rows are only slightly enlarged. On the other hand, a specimen from the northern end of Key Largo, at the northern end of the Florida Keys, has stripes that nearly reach the tail, and has enlarged dorsal scales. Considerably more material is needed from the upper keys before a definite assignment of the population can be made.

Fifteen adults from Key West have snout-vent lengths from 42 to 57 (48.7) mm., and six have tail lengths from 57 to 60 (58.5) mm.

Specimens were secured at Key West and Stock Island from beneath stones on sand in shaded areas. Babbitt (1951) described the courtship and breeding of this lizard at Key West. Although known from only a few of the keys, the species probably ranges throughout the chain of islands. Locality records for 43 specimens are:

Monroe County: Big Pine Key (3), Indian Key (2), Key Largo (1), Key West (26), Stock Island (7), Tortugas (1), Upper Matecumbe Key (3).

Eumeces egregius onocrepis Cope

Only two specimens of this form were encountered during our field work in southern Florida. Both were taken in sandy areas near dwellings in Miami. These specimens have snout-vent lengths of 38 and 44 mm. and tail lengths of 44 and 55 mm. Individuals from the southern part of the peninsula have short stripes on the dorsum; these usually terminate above the insertion of the forelimbs. The median dorsal scales are not noticeably enlarged, and the dorsal ground color is a darker brown than that found in *Eumeces e. egregius*.

This form has been found in southern Florida only on the eastern rim. However, McConkey (1957) reported specimens from Sarasota County on the Gulf coast. It is likely that *onocrepis* will be found in the vicinity of Naples and on Marco Island in Collier County. Locality records for 8 specimens are:

Dade County: Coconut Grove (1), Coral Gables (1), Lemon City (3), Miami (3).

Eumeces inexpectatus Taylor

Eleven males from Miami have snout-vent lengths from 55 to 77 (66.8) mm., 18 females, 49 to 78 (65.4) mm. The largest specimen, a female, has a snout-vent length of 86 mm. There is little geographical variation in size or scutellation in this lizard in peninsular Florida. Populations on the upper keys, lower keys, and the mainland are apparently homogeneous. This might be accounted for by the apparent ease with which these lizards are able to move about, enter new areas, and becoming established. Individuals from southern Florida have from 53 to 58 dorsal scales and 30 to 32 scales around the body. The former range is essentially the same as that given by Taylor (1935: 228), while the latter shows a somewhat smaller amount of variation than that given for the whole range of the species.

This skink is found in all terrestrial habitats in southern Florida. Perhaps it is most abundant around human inhabitations where individuals may be seen sunning on buildings or fences. Many have been found in trees. At Birch State Park numerous individuals were observed on the trunks of coconut palms. Two specimens were found in a cavity in a *Casuarina* along the Tamiami Trail; they shared the cavity with an *Elaphe obsoleta*. At Taylor Slough near Paradise Key an individual was observed swimming vigorously for a distance of five feet before it climbed onto a leaf of a water lily. Carr (1940: 77) mentioned an individual jumping from a log into the water and not coming to the surface even after ten minutes.

On 23 June 1953, a female coiled about a clutch of 11 eggs was found beneath a log. The female measured 58 mm. in snout-vent length. The eggs were white, spheroid, and averaged 13.2 by 10.3 mm. On 24 June 1953, a pair was observed in copulation. The smallest individuals, averaging about 25 mm. in snout-vent length, were collected in June; these probably represent young of the year.

Examination of the stomach contents of several specimens showed fragmentary arthropod remains, mostly pieces of chitinous exoskeleton presumably from beetles.

Locality records for 189 specimens are:

Broward County: Birch State Park (6), Ft. Lauderdale (4), 9.5 mi. W Ft. Lauderdale (1), Hollywood (2), 28 mi. NW Miami (8). *Collier County*: Everglades (1), Fachahatchee Island, near Everglades (23), Goodland Point, near Marco (1), Key Island (1), Naples (2), 3 mi. S Naples (2), Royal Palm Hammock (1), Tamiami Trail (1). *Dade County*: Coconut Grove (3), Coral Gables (13), 5 mi. S Coral Gables (5), Cox Hammock (1), "Everglades" (1), 6 mi. E Florida City (1), Homestead (2), 9 mi. E Homestead (1), Lee Hammock (1), Lemon City (1), Long Pine Key (2), Miami (56), 15 mi. W Miami (4), 19 mi. W Miami (1), 34.3 mi. W Miami (2), 36 mi. W Miami (1), 3.2 mi. NE Miami Springs (2), North Miami (1), Opa-locka (1), Paradise Key (7), 6 mi. W Paradise Key (1), 2 mi. NE Pensuco (2), South Miami (1). *Monroe County*: Big Pine Key (6), Boca Chica Key (1), Cudjoe Key (2), Indian Key (1), Key Largo (6), Key West (3), Little Pine Key (1), Pinecrest (1), 6.3 mi. SW Pinecrest (1), Sugarloaf Key (2), Tortugas (2).

Eumeces laticeps Schneider

Two specimens of this skink (UMRC 54-23) were collected by Jay A. Weber in Coral Gables. The male has a snout-vent length of 112 mm.; a female, a snout-vent length of 85 mm. and a tail length of 118 mm.

Since the closest known records of *E. laticeps* are in Volusia County, nearly 200 miles to the north, the occurrence of this species in the southern part of the peninsula is badly in need of substantiation. Only the two individuals from Coral Gables, Dade County, are available.

Neoseps reynoldsi Stejneger

Two specimens from Dade County have snout-vent lengths of 54 and 49 mm.; the total length of the larger specimen is 99 mm.

We have had no experience with this species in southern Florida. The two specimens mentioned above (USNM 85248-249) purportedly were taken by M. K. Brady at Miami (Buena Vista and Deering Estate) in February 1932, and none has been taken in that area since. A confirmed burrower, *Neoseps* has been reported as occurring in rosemary scrub and high pine woods, and under logs and in loose dry soil (Carr, 1940: 77). Since the species has been recorded in rosemary scrub, it is conceivable that specimens will eventually be taken in such habitat in Collier, Broward, and northern Dade counties, and that the species is more widespread than the meager records now indicate. However, the presence of the species in southern Florida is in need of verification. Only the two individuals from Miami, Dade County, are available.

Diadophis punctatus punctatus Linnaeus

Twelve males from the mainland of southern Florida have 132 to 136 (133.8) ventrals, 44 to 49 (46.5) caudals, and tail/body ratios from 23.7 to 32.4 (27.4); six females have 138 to 143 (141.3) ventrals, 41 to 42 (41.7) caudals, and tail/body ratios from 21.7 to 24.2 (22.7). A female from Key Largo, and a female and a male from Big Pine Key have, respectively, 137, 132, and 126 ventrals; 40, 43, and 47 caudals, and tail/body ratios of 21.2, 23.6, and 30.4. The number of ventrals, particularly on those individuals from Big Pine Key, is much lower than that found on the mainland. The average numbers of ventrals and caudals and the tail/body ratios for fourteen males and four females from Alachua County in northern Florida are, respectively for males and females, 135.8 and 135.0 ventrals, 44.6 and 39.5 caudals, 25.5 and 20.3 tail/body ratio. The caudals and ventrals are noticeably fewer in the series from northern Florida as compared with that from the mainland of southern Florida. In number of ventrals, individuals from the keys more closely approximate the condition found in specimens from northern Florida than they do those from the southern part of the peninsula.

The largest male from southern Florida has a body length of 240 mm. and a tail length of 63 mm.; the largest female measures 248 mm. and 60 mm. A juvenile with a prominent umbilical scar has a body length of 80 mm. and a tail length of 19 mm.

In 18 specimens from the southern part of the peninsula, eight (44%) have the light nuchal ring interrupted middorsally by a stripe of ground color; in the others the ring is complete. The ring is interrupted in 17 (94%) of 18 specimens from northern Florida. The specimen from Key Largo has a broad complete ring, and the head is black, like specimens from the mainland. Two individuals from Big Pine Key have an indistinct nuchal ring that is reduced to a pair of light spots dorsolaterally; in these the top of the head is gray. Additional material from the lower keys may show that the population there is worthy of subspecific designation.

In southern Florida *Diadophis* inhabits the pine woods and hammocks; although a few individuals have been found along the roadways in the Everglades and in wet situations, it is doubtful if the species lives in the extensive saw grass prairies. Locality records for 52 specimens are:

Broward County: Ft. Lauderdale (3). *Collier County*: Everglades (1), 1 mi. SE Naples (1), Royal Palm Hammock (1), 11.7 mi. ESE Royal Palm Hammock (1). *Dade County*: Coconut Grove (2), Coral Gables (3), 3.4 mi. W Florida City (1), Homestead (2), 2 mi. W Homestead (1), Lee Hammock (1), Lemon City (14),

Miami (7), 13.9 mi. W Miami (1), 22 mi. W Miami (1), Paradise Key (4). *Monroe County*: Big Pine Key (3), Cape Sable (1), 3 mi. N, 1.1 mi. E Flamingo (1), Key Largo (1), Pinecrest (2).

Heterodon platyrhinos Latreille

Heterodon platyrhinos Latreille, in Sonnini and Latreille, 1802, *Histoire Naturelle Reptiles*, vol. 4, p. 32. Edgren, 1952, *Nat. Hist. Misc.*, no. 112, p. 1.

Heterodon browni Stejneger, 1903, p. 123.

Fourteen males from the mainland of southern Florida have 112 to 120 (116.7) ventrals and 48 to 54 (50.6) caudals; three females have 126 to 131 (128.3) ventrals and 43 to 48 (46.0) caudals. One female from Key Largo has 121 ventrals and 45 caudals. Sixteen males from northern Florida have an average of 124.2 ventrals, and seven females have 134.6. The species *browni* was diagnosed by Stejneger (1903) as lacking the azygous plate. Of 24 specimens from the mainland of southern Florida, eight (33%) have the azygous plate missing; six (25%) have a reduced plate; in ten (42%) the plate is present and normal. These findings agree with those of Edgren (1957) who has presented evidence to show that *browni* is not a recognizable entity.

The color pattern of specimens from southern Florida shows considerable variation. Twelve from the mainland have from 16 to 19 (16.8) middorsal brown blotches on the body. The individual from Key Largo has 19 blotches. One specimen (AMNH 48471) from Miami has 9 broad brown bands on the body with large brown spots in the cream interspaces; another (CM 26039) has a light tan ground color with black squarish blotches arranged in groups of four around a central cream spot.

Heterodon is not an abundant snake in southern Florida; the largest series of specimens comes from Opa-locka, an area of open sandy soil with scattered pines. One specimen is known from Key Largo; no others have been reported from the keys, although the presence of the species on Big Pine Key would be expected. The absence of *Heterodon* from the sandy pine woods west of the Everglades may be more apparent than real. Locality records for 29 specimens are:

Broward County: Ft. Lauderdale (1), 8 mi. W Hallandale (1). *Dade County*: Cape Sable road (1), Coconut Grove (5), Homestead (2), Lemon City (7), Miami (2), Opa-locka (9). *Monroe County*: Key Largo (1).

Farancia abacura abacura Holbrook

There is considerable sexual dimorphism in the numbers of ventrals and caudals; seven males from southern Florida have 171 to 177

(174.4) ventrals and 44 to 49 (46.8) caudals, and nine females have 186 to 200 (191.2) ventrals and 33 to 36 (34.7) caudals. These counts are only slightly different from the means of ten specimens of each sex from Alachua County—males with 174.3 ventrals and 47 caudals, and females with 195 ventrals and 36.2 caudals.

Specimens from southern Florida have fewer red bars on the sides than do those from northern Florida. Fifteen adults from the southern part of the state have 43 to 63 (55.8) red bars, whereas 20 adults from Paynes Prairie, Alachua County, have 56 to 66 (61.1) bars. Although red bars are fewer, the area covered with red is considerably greater. In southern specimens the red bars extend dorsally 3 to 8 (4.9) scale rows; in those from Paynes Prairie the bars extend 2 to 4 (2.8) scale rows. In some individuals from southern Florida the bars continue across the body anteriorly, and in two specimens there are narrow red transverse bands posteriorly to the midbody region. However, in no instance is there the degree of reduction of black pigment mentioned by Etheridge (1950) for what appeared to be an erythristic individual from western Florida.

The largest specimen examined, a female, has a body length of 1734 mm. and a tail length of 296 mm. A juvenile female has a body length of 217 mm. and a tail length of 30 mm. A female with a body length of 1105 mm. contained 35 eggs.

This species is confined to the Everglades and sloughs in southern Florida. Most of the specimens were collected on roadways at night; some were found in masses of water hyacinths during the day, at which time on two different occasions they were observed struggling with large salamanders, either *Amphiuma* or *Siren*. Locality records for 21 specimens are:

Broward County: 4 mi. W Ft. Lauderdale (1), 5.4 mi. N, 22 mi. W Ft. Lauderdale (1), 15 mi. W Ft. Lauderdale (1), 20 mi. S 20-Mile Bend (1). *Collier County*: 1.5 mi. NW Carnestown (1), 20 mi. E Ochopee (1), 10.5 mi. ESE Royal Palm-Hammock (1). *Dade County*: 15 mi. W Miami (2), 17 mi. W Miami (1), 19 mi. W Miami (2), 19 mi. W, 2.1 mi. S Miami (2), 21.5 mi. W Miami (3), 24.8 mi. W Miami (1), 33 mi. W Miami (1), 40 mi. W, 1 mi. NW Miami (1). *Monroe County*: Pinecrest (1).

Coluber constrictor paludicola Auffenberg and Babbitt

Coluber constrictor paludicola Auffenberg and Babbitt, 1953, Copeia, no. 1, p. 44.

Two races of *Coluber constrictor* inhabit southern Florida, *paludicola* in the Everglades and *priapus* to the west and east of the Everglades and on the Florida Keys. The variation in the species will

be discussed under this race in the light of Auffenberg's (1955) revision of the species and the material collected for the present survey.

Typical *Coluber c. paludicola* are found in the Everglades. The snakes from this region normally are bluish gray above and bluish white or grayish cream below. A few individuals from the Everglades present a grayish-green or grayish-tan color dorsally. Usually the snout is olive brown. These light-colored snakes are found from the eastern edge of the Everglades westward to the vicinity of Monroe Station in Collier County and southward to Cape Sable. Individuals from Key Largo also are light colored.

Black individuals, the subspecies *priapus*, with bluish-black bellies and white chins are found on the eastern rim as far south as southern Broward County, and in the western part of the state to Marco Island. A disjunct population of this race is found on the lower keys.

Intergrades having dark gray dorsal and bluish ventral colors are found along the eastern periphery of the Everglades from southern Broward County to the vicinity of Miami, and on the eastern rim from Miami southward to Homestead. Intermediate individuals between the light-colored form on Key Largo and the dark one on the lower keys are found on the Matecumbe Keys. To the west intergrades have been found in the cypress-pine habitats of central Collier County.

Specimens from the keys have fewer ventral and caudal scutes than those from the southern part of the mainland; individuals from the Florida Keys have scutellation characters more closely resembling those found in racers from northern Florida (see table 14).

TABLE 14

GEOGRAPHICAL VARIATION IN THE NUMBERS OF VENTRALS AND CAUDALS IN
Coluber constrictor.

Locality *	N	Ventrals	N	Caudals
Alachua Co.	18	172-181 (177.3)	16	96-109 (106.3)
Miami	21	179-188 (183.4)	19	99-115 (110.1)
Everglades	28	178-185 (181.9)	23	97-113 (108.9)
Upper keys	10	171-180 (176.1)	8	96-108 (104.7)
Lower keys	21	169-181 (175.8)	17	94-106 (101.2)

* Those from the east coast ridge of Dade County are grouped under Miami; those from the saw-grass prairies of western Dade County and extreme eastern Collier County are grouped under Everglades; those from Key Largo southward to Grassy Key are grouped under upper keys; and those from Big Pine Key to Key West are grouped under lower keys. Little sexual dimorphism is apparent; consequently the sexes are combined.

The light-colored racers essentially are confined to prairie habitats, not only in southern Florida but to the north of Lake Okeechobee in the Kissimmee Prairie. On the other hand, black racers inhabit the pine forests and hammocks. In southern Dade County where the eastern rock rim breaks into a series of "islands" of pine woods separated by sloughs that are fingers of the Everglades, the racers are intermediate between the bluish gray *paludicola* and the black *priapus*. Although geographically remote the population on the lower keys is in most characteristics like that of northern Florida and shows little resemblance to that in the southern part of the peninsula. Racers from the upper keys essentially are intergrades between *paludicola* and *priapus*.

C. c. paludicola has been collected in all parts of the fresh-water Everglades, in cabbage palm hammocks, in salt marshes, and in mangrove swamps. On Key Largo, individuals referred to this race have been found in mesophytic hammock. Locality records for 44 specimens of *paludicola*, followed by those of 38 intergrades are:

Broward County: 2 mi. S junction Ft. Lauderdale road and Okeechobee-Miami road (1). *Collier County*: 1 mi. WNW Dade-Collier county line, Tamiami Trail (1). *Dade County*: Elliott Key (1), "Everglades" (2), 7.3 mi. SW Florida City (1), north of Homestead (1), 4.5 mi. S Homestead (1), 1 mi. N Kendall (1), 3 mi. W Kendall (1), Long Pine Key (1), 17 mi. W Miami (2), 19 mi. W Miami (5), 24 mi. W Miami (1), 30.3 mi. W Miami (2), 36 mi. W Miami (1), 36 mi. W, 7 mi. S Miami (2), 40 mi. W Miami (1), 10 mi. NNW Miami (3), between New South River and Miami (1), Paradise Key (2), 3 mi. E Paradise Key (3), 3-5 mi. SW Paradise Key (2), 4 mi. N Paradise Key (1), Perrine (1). *Monroe County*: Flamingo (1), Key Largo (3), Middle Cape, Cape Sable (1), Tavernier, Key Largo (1).

Broward County: 8 mi. W Hallandale (1). *Collier County*: Copeland (3). *Dade County*: Chapman Field (2), Coconut Grove (2), Cutler (1), Homestead (1), Lemon City (4), Miami (10), 3 mi. SW Miami (2), 10.7 mi. W Miami (1), 10 mi. NNW Miami (1), South Miami (2). *Monroe County*: Lower Matecumbe Key (6), Upper Matecumbe Key (2).

Coluber constrictor priapus Dunn and Wood

Coluber constrictor priapus Dunn and Wood, 1939, Notulae Naturae, no. 5, p. 4. Auffenberg, 1955, p. 97.

Coluber constrictor haasti Bell, 1952, Herpetologica, vol. 8, pt. 2, p. 21.

The variation in this form has been discussed under the preceding subspecies.

Specimens of *Coluber c. priapus* have been collected in dry pineland, rosemary scrub, and in the rocky pineland of the lower keys. Locality records for 38 specimens are:

Broward County: Hollywood (4). *Collier County*: Goodland Point, near Marco (1), 7.9 mi. NW Royal Palm Hammock (1). *Monroe County*: Big Pine Key (6), Grassy Key (1), Key West (23), Stock Island (1), Tortugas (1).

Masticophis flagellum flagellum Shaw

Three males from the mainland of southern Florida have 191 to 204 (197.7) ventrals and 104 to 109 (103.3) caudals; four females have 187 to 199 (192.5) ventrals and 97 to 102 (99.9) caudals. The largest specimen examined is a male with a body length of 1645 mm. and an incomplete tail.

Most of the specimens of *Masticophis* come from the eastern rim where they are found in the pine woods. One has been found on a sandy island off the Gulf coast and another at Pinecrest, an isolated pine "island" in the Everglades. These snakes never have been observed in the Everglades. Locality records for 12 specimens are:

Collier County: Key Island, south of Naples (1). *Dade County*: Biscayne Key (1), Lemon City (2), Miami (5), 3 mi. S Miami (1), Peters (1). *Monroe County*: Pinecrest (1).

Opheodrys aestivus Linnaeus

Ten males from Dade County have 152 to 159 (156.1) ventrals and 130 to 138 (135.2) caudals; 10 females have 161 to 165 (163.2) ventrals and 113 to 128 (120.0) caudals. Five males and 5 females from the lower keys have, respectively, 152 to 156 (154.1) and 158 to 163 (161.7) ventrals, and 135 to 139 (136.4) and 120 to 124 (122.7) caudals. Five males from the vicinity of Gainesville, Alachua County, Florida have 149 to 154 (152.0) ventrals and 127 to 136 (129.3) caudals.

Specimens from southern Florida have pale greenish-white or pure white bellies as compared with the creamish-yellow bellies of more northern specimens. We have not seen sufficient material from northern and central Florida to determine where the change in ventral coloration takes place.

The largest specimen recorded from southern Florida is from Key West and has a body length of 735 mm. and a tail length of 425 mm. (Allen and Slatten, 1945).

Opheodrys is a widespread and abundant snake in southern Florida. It is encountered in willow hammocks and in overgrown fields, but most frequently in marshy places. However, it is not found in the Everglades. It occurs on the upper and lower keys. In April and May *Opheodrys* is often found active during the day; large numbers may be collected on bushes at night. During the summer months only occasional individuals are encountered. Locality records for 85 specimens are:

Broward County: southern Broward County (1), 1 mi. NNW Ft. Lauderdale (1). *Collier County*: 1 mi. S Monroe Station (1). *Dade County*: Coconut Grove (2), Coral Gables (3), 5 mi. NW Hialeah (1), Homestead (6), 9 mi. N, 6 mi. W Homestead (1), Lemon City (1), 1 mi. NW Medley (1), Miami (10), 11 mi. W Miami (4), 10 mi. NNW Miami (9), 11 mi. WNW Miami (1), 20 mi. NW Miami (1), Paradise Key (2). *Monroe County*: Big Pine Key (4), Johnston Key (1), Key Largo (1), Key West (29), Lignumvitae Key (1), Matecumbe Key (1), Upper Matecumbe Key (3).

Drymarchon corais couperi Holbrook

Eight males from southern Florida have 184 to 191 (187.1) ventrals and 64 to 70 (67.0) caudals; three females have 187 to 190 (189.0) ventrals and 64 to 68 (66.3) caudals. Large adults from the mainland and the keys are black above and bluish black below; the labials are reddish brown. Small adults that have lost the juvenile dorsal pattern and are black above may have the entire venter yellowish or reddish brown. Apparently the bluish-black coloration appears first posteriorly and progresses anteriorly with age. Small adults have the sides of the head colored with reddish brown. The largest specimen that we have collected in southern Florida is a male with a body length of 1525 mm. and an incomplete tail. Babis (1949) reported a six-foot specimen from Everglades National Park that contained two *Sistrurus miliarius* and four turtle eggs.

Drymarchon probably is more abundant in southern Florida than our few specimens indicate; apparently the species is widely distributed throughout the southern part of the peninsula and on at least the upper keys. Locality records for 16 specimens are:

Collier County: 10 mi. SE Naples (1). *Dade County*: no additional data (1), 10 mi. S Florida City (1), 9 mi. N, 2 mi. W Homestead (1), Lemon City (1), Miami (1), 45 mi. W Miami (1), 5 mi. N Paradise Key (1), 11 mi. E Paradise Key (1), 2.5 mi. S South Miami (1). *Monroe County*: Cape Sable (1), Key Largo (2), Pinecrest (2), Sugarloaf Key (1).

Elaphe guttata guttata Linnaeus

Coluber guttatus Linnaeus, 1766, Systema Naturae, ed. 12, vol. 1, p. 381.

Coluber rosaceus Cope, 1888, Proc. U.S. Natl. Mus., vol. 11, p. 388.

Elaphe guttata guttata, Dowling, 1952, p. 2.

Elaphe guttata rosacea, Dowling, 1952, p. 2.

When specimens of *Elaphe guttata* from northern Florida are compared with those from the southern part of the peninsula and from the Florida Keys, only minor differences in scutellation are noticeable (table 15). In general there is a slight trend toward a higher number of ventrals and caudals from north to south. The only ob-

vious diversion from this trend is on the upper keys, where there is a considerable increase in the number of caudals over that found in individuals from the southern part of the peninsula.

TABLE 15
GEOGRAPHICAL VARIATION IN *Elaphe g. guttata* IN FLORIDA.

Locality	N	Sex	Ventrals	Caudals	Body blotches
Alachua County	11	♂	213-223 (218.2)	68-73 (71.0)	31-42 (37.1)
	13	♀	221-230 (226.9)	62-68 (64.7)	33-41 (37.4)
Dade County	18	♂	215-224 (219.0)	69-75 (72.7)	31-44 (37.6)
	17	♀	223-233 (228.1)	63-68 (65.1)	35-41 (37.9)
Upper keys	6	♂	217-225 (221.0)	74-80 (77.0)	31-37 (33.8)
	4	♀	227-234 (230.0)	63-68 (65.1)	30-33 (31.5)
Lower keys	12	♂	218-227 (222.1)	73-79 (76.8)	32-40 (38.0)
	16	♀	228-233 (231.0)	66-72 (68.1)	29-40 (37.0)

In coloration a great deal of variation is encountered in the intensity of the red blotches and in the distinctness of the dark borders of the red blotches. Individuals from northern Florida and the Atlantic coastal plain generally have dark red blotches well outlined with a darker color. In southern Florida the reddish color is lighter, although occasional individuals have bright red blotches. On the Florida Keys, especially on the lower keys, many individuals have pale red or pink blotches that are indistinctly outlined with a darker color. In some the color of the blotches is almost indistinguishable from the ground color. That the entire population on the lower keys is not characterized by this faded color pattern is attested to by the presence of individuals with dark red blotches from Key West and Big Pine Key. All juveniles and small individuals from the lower keys have a distinct color pattern of dark red blotches on a lighter background. Apparently the faded dorsal color pattern in many of the snakes is an ontogenetic change.

The differences in scutellation between peninsular and insular populations of *Elaphe guttata* appear to be of minor consequence and clinal in nature. The coloration also seems to follow a general trend from snakes with dark red blotches to the north to those with faded blotches to the south, with extreme fading on the lower keys. The presence of individuals from the lower keys that resemble mainland specimens in coloration together with the fact that "specimens of *guttata* decidedly resembling *rosacea* are occasionally found even

in north Florida" (Neill, 1949b: 10), suggest that the recognition of the population of *Elaphe guttata* on the Florida Keys as a distinct species or as a subspecies of *E. guttata* is not merited. *Elaphe g. rosacea* Cope therefore should be placed in the synonymy of *Elaphe g. guttata* Linnaeus.

Red rat snakes are abundant in hammocks and in the pine woods of southern Florida; although occasional individuals are found along roadbeds in the Everglades, the species appears to avoid the Everglades proper. On the upper keys the snakes are found in the dense mesophytic hammocks; on the lower keys they have been encountered in hammocks, pine woods, and in edificarian situations in the city of Key West. Locality records for 167 specimens are:

Broward County: 7.1 mi. WNW Ft. Lauderdale (1), Hollywood (1), 3.3 mi. W Hollywood (1). *Collier County*: Naples (1). *Dade County*: Coconut Grove (2), Coral Gables (7), Cox Hammock (1), 4.9 mi. SW Florida City (1), Homestead (3), 2 mi. N, 6 mi. E Homestead (9), 2 mi. N, 6 mi. W Homestead (4), 5.3 mi. N Homestead (2), 14 mi. NE Homestead (1), 7 mi. E Homestead (1), 9 mi. E Homestead (22), Lemon City (7), Miami (20), 9.1 mi. W Miami (1), 15.1 mi. W Miami (1), 19 mi. W, 2 mi. S Miami (1), 23 mi. W Miami (1), 26 mi. W Miami (1), Ojus (1), Paradise Key (1), 2.5 mi. SW Paradise Key (1), 11.3 mi. SW Paradise Key (1), 6.3 mi. NE Paradise Key (1), 8.9 mi. NE Paradise Key (1), 3 mi. SW, 6 mi. E Perrine (3), Tamiami Trail (1). *Monroe County*: Bahia Honda Key (1), Big Pine Key (3), Boca Grande Key (1), Cape Sable (2), Key Largo (7), Key Vaca (1), Key West (38), Indian Key (1), 13 mi. N Key West (1), Little Pine Key (1), Lower Matecumbe Key (4), 5.5 mi. S, 6.3 mi. E Monroe Station (1), Matecumbe Key (1), Stock Island (1), Sugarloaf Key (1), Upper Matecumbe Key (3), Windley's Key (1).

Elaphe obsoleta quadrivittata Holbrook

Coluber quadrivittatus Holbrook, 1836, North American Herpetology, ed. 1, vol. 1, p. 113.

Elaphe quadrivittata deckerti Brady, 1932, Proc. Biol. Soc. Washington, vol. 45, p. 5.

Elaphe obsoleta quadrivittata (part), Dowling, 1952, p. 5.

In southern Florida there are two subspecies of *Elaphe obsoleta*—*quadrivittata* in extreme western Florida and on the eastern rim and upper keys, and *rossalleni* in the Everglades and associated wet prairies. The general variation of both subspecies in southern Florida is discussed here.

Southern Florida *Elaphe obsoleta* show the following variation in scutellation: ventrals 220 to 238 in males and 227 to 239 in females; caudals in males, 84 to 95, in females, 70 to 80. An analysis of variation in ventrals and caudals is given in table 16. In general the snakes from the upper keys, the eastern rim in southern Florida, and from

northern Florida have approximately the same variation in ventrals and caudals; in the Everglades the number of ventrals and caudals is lower.

TABLE 16

GEOGRAPHICAL VARIATION IN NUMBERS OF VENTRALS AND CAUDALS IN
Elaphe obsoleta IN CENTRAL AND SOUTHERN FLORIDA.

Locality	N	Sex	Ventrals	Caudals
Alachua County	6	♂	236-241 (238.2)	89-102 (93.6)
	9	♀	234-242 (239.1)	74-82 (76.9)
Miami	7	♂	232-237 (235.2)	91-95 (92.9)
	8	♀	234-239 (237.6)	73-77 (75.3)
Everglades *	10	♂	220-233 (228.8)	84-92 (88.4)
	8	♀	227-234 (230.4)	70-77 (74.2)
Upper keys	8	♂	233-238 (236.7)	85-93 (89.2)
	6	♀	235-239 (237.9)	72-80 (76.1)

* The locality "Everglades" refers to the region and not to the city in Collier County. Specimens from western Dade and eastern Collier counties are grouped under this name.

The dorsal ground color of *E. o. quadrivittata* varies from a pale straw in the northern part of the state to a light tan on the upper keys. The longitudinal stripes are dark brown and are distinct. In the southern part of the range, particularly on the upper keys, there is a tendency to retain the dorsal blotches of the juvenile color pattern. These blotches usually are not distinct in adult snakes, but in a few individuals they are the same color as the longitudinal stripes. The population in the Everglades, here considered to be the subspecies *rossalleni*, has an orange or orange-brown dorsal ground color with indistinct brownish longitudinal stripes and no indication of dorsal blotches. Previous workers have considered the straw-colored snakes in northern Florida and in the Atlantic coastal plain to be the race *quadrivittata*, and the tan snakes with a residual juvenile pattern in the adults to be the subspecies *deckerti*. Neill (1949b) pointed out the existence of the orange snakes in the Everglades and for that population proposed the name *rossalleni*. The differences between the population on the upper keys (*deckerti*) and that on the mainland east and north of the Everglades (*quadrivittata*) are trivial; what differences are present appear to be clinal, for individuals from the eastern mainland of southern Florida often show faint dorsal blotches and have a darker ground color than do those to the north. In this way they are intermediate between the northern populations and the

population on the upper keys. It appears as though the geographical pattern of differentiation is essentially the same as that in *Coluber constrictor*; that is, with a widespread form over most of the mainland of Florida and also on the Florida Keys and with a distinct population inhabiting the Everglades and associated prairie habitats in south-central Florida.

In southern Florida *E. o. quadrivittata* has been collected in pine-lands, hammocks, and open scrubby habitats. Although apparently uncommon, it is found in the sandy pineland west of the Everglades in Collier County. Surrounding the Everglades, in areas of cypress-pine habitat and sawgrass-rocky pineland ecotone, intergrades between *quadrivittata* and *rossalleni* are found. The subspecies *quadrivittata* is found on the coral limestone or upper keys. A specimen bearing the locality "Key West" (MCZ 31644) may have erroneous data; if not, it is the only individual known from the lower keys. Locality records for 40 *quadrivittata* followed by those for 22 intergrades with *rossalleni* are:

Broward County: 2 mi. W Ft. Lauderdale (1). *Collier County*: Goodland Point, near Marco (1). *Dade County*: Coral Gables (2), Homestead (5), Lee Hammock (2), Lemon City (2), Miami (5). *Monroe County*: Key Largo (5), Lower Matecumbe Key (11), Matecumbe Key (4), Pumpkin Key (1), Upper Matecumbe Key (1).

Collier County: Deep Lake (1), Ochopee (1), 2.2 mi. ESE Royal Palm Hammock (1), 4.8 mi. ESE Royal Palm Hammock (1). *Dade County*: Atoll Hammock, near Paradise Key (1), Long Pine Key (4), 15 mi. W Miami (1), 16 mi. W Miami (1), 16.8 mi. W Miami (1), Palma Vista Hammock (1), Paradise Key (7), 3 mi. SW Paradise Key (1). *Monroe County*: 6.1 mi. S Monroe Station (1).

Elaphe obsoleta rossalleni Neill

Elaphe obsoleta rossalleni Neill, 1949b, p. 1.

Elaphe obsoleta quadrivittata (part), Dowling, 1952, p. 5.

The population of *Elaphe obsoleta* inhabiting the Everglades and adjoining prairie habitats to the north is composed of snakes usually having an orange ground color, indistinct grayish-brown longitudinal stripes, an orange iris, and a reddish tongue. The distinguishing characters of this population are not evident in preserved specimens; however, living individuals are readily differentiated from typical *quadrivittata*. Although the sample is not large, snakes from the Everglades appear to have noticeably fewer ventrals and caudals than do those from the eastern rim; north-central Florida, and the upper Florida Keys (*quadrivittata*). Ten males from western Dade

County have 220 to 233 (228.8) ventrals and 84 to 92 (88.4) caudals; eight females have 227 to 234 (230.4) ventrals and 70 to 77 (74.2) caudals. In table 16 *quadrivittata* is compared with *rossalleni*.

Allen and Neill (1950) stated that the range of *Elaphe obsoleta rossalleni* consisted of the Everglades and part of the Big Cypress Swamp. More recently Neill (1954) included the northern prairie regions of the Kissimmee Prairie in the range of the subspecies. We have collected this snake throughout the Everglades from central Dade and northern Monroe counties northward to Lake Okeechobee and then to the north in the Kissimmee Prairie. Individuals have been found in strictly saw-grass prairie situations, in willow hammocks, in mesophytic hammocks in the Everglades, and in bushes and trees along canals, especially in *Casuarina* along the Tamiami Trail. On the mainland the range is much the same as that of *Coluber constrictor paludicola*; however, the range of intergradation does not extend onto the upper keys as in that species. Locality records for 22 specimens are:

Dade County: 19-21 mi. W Miami (3), 23-25 mi. W Miami (4), 27-30 mi. W Miami (4), Osteen Hammock, northwest of Paradise Key (1), Tamiami Trail (1). *Monroe County*: Pinecrest (9).

Pituophis melanoleucus mugitus Barbour

A single specimen from the region of study is a male from the southwestern part of Miami, Dade County; it has 213 ventrals and 52 caudals. There are 24 middorsal dark brown blotches on the body; body length, 1428 mm.; tail length, 216 mm.

Our specimen (UMRC 55-394) is from the rocky pineland on the eastern rim. The species may occur in the pine forests west of the Everglades; we have collected it on the west coast in Charlotte County.

Lampropeltis doliata doliata Linnaeus

Ten males from the mainland of southern Florida have 164 to 170 (167.6) ventrals and 40 to 44 (41.8) caudals; 12 females have 171 to 177 (174.0) ventrals and 35 to 39 (36.8) caudals. The number of red bands on the body varies from 13 to 19 (16.2); 17 individuals from northern Florida have 14 to 19 (17.1) bands.

The largest specimen is a female with a body length of 482 mm. and a tail length of 73 mm. A female deposited eggs on 5 June; six of the eggs were adherent. The average size of the eggs was 25 by 11 mm.

This snake has been encountered most frequently in pine woods on the eastern rim of the mainland. It has been found beneath pine logs during the day; active individuals have been taken on roads at night. The species also occurs in hardwood hammocks; however, it apparently is absent in the Everglades.

One specimen (UMMZ 67741) collected by S. J. Kerstell in 1929 bears the locality "Key West." To our knowledge this is the only individual reported from the keys. In view of the abundance of specimens from the mainland and lack of individuals from the keys, despite intensive collecting, we feel that the record should be considered doubtful until verified. Locality records for 51 specimens are:

Broward County: 8 mi. W, 6 mi. S of Hallandale (1). *Collier County*: 7 mi. N, 4 mi. W Deep Lake (1), 2 mi. E Monroe Station (1). *Dade County*: Coconut Grove (2), Coral Gables (10), Hialeah (1), Lemon City (12), Miami (10), 16 mi. W Miami (1), southwest of Miami (1), 18 mi. S Miami (1), Miami Beach (3), Miami Springs (1), Opa-locka (1), Paradise Key (2), South Miami (1). *Monroe County*: ?Key West (1), Pinecrest (1).

Lampropeltis getulus floridana Blanchard

Lampropeltis getulus floridanus Blanchard, 1919, Occas. Papers Mus. Zool. Univ. Michigan, no. 70, p. 1.

Lampropeltis getulus brooksi Barbour, 1919, Proc. New England Zool. Club, vol. 7, p. 1.

The king snakes of southern Florida are highly variable in dorsal color pattern. In northern Florida the dorsal ground color is dark brown to black; there are numerous narrow yellow crossbands that are connected on the lower scale rows and ventrals to surround distinct dark blotches. Typically in central Florida the blotches are distinct, dark brown or black, and the crossbands are narrower. This kind of color pattern continues into southern Florida. Also in the southern part of the peninsula are found snakes in which the light crossbands are indistinct or absent; the ground color in these is light tan, cream, or yellow, and the tips of the scales are dark. Seventeen individuals from central Florida have 29 to 51 (37.2) light crossbands. Snakes from the region west of Lake Okeechobee (Charlotte, DeSoto, and Hendry counties) have a brown dorsal ground color with rather distinct light crossbands and some light scales in the dorsal brown blotches; twelve snakes from that area have 34 to 70 (49.7) light crossbands. In extreme southern Florida (Collier, Dade, and Monroe counties) the crossbands are absent in seven specimens; in seventeen

others they vary in number from 50 to 75 (57.0). Individuals with the light dorsal ground color, numerous crossbands (sometimes absent), and dark-tipped dorsal scales are found to the north of Lake Okeechobee in the Kissimmee Prairie (Okeechobee and Osceola counties); eight specimens from that area have the highest number of crossbands of any of the populations sampled. They vary from 60 to 74 (67.2); two other individuals have no discernible crossbands. Wilfred T. Neill called our attention to a population of king snakes in Polk County that deserves special mention. Two specimens from near Haines City, Polk County, have light brown dorsal blotches with the tips of the scales dark and 54 and 57 indistinct yellow crossbands.

Eighteen males from southern Florida have 213 to 219 (215.4) ventrals and 48 to 57 (52.8) caudals; 14 females have 209 to 217 (213.4) ventrals and 42 to 47 (44.8) caudals. The differences between these counts and those for eight individuals of each sex from north-central Florida are slight (males 211 to 225 [218.4] ventrals and 47 to 56 [51.4] caudals; females 205 to 219 [214.6] ventrals and 40 to 48 [45.0] caudals). Thus, in attempting to differentiate races of *Lampropeltis getulus* in southern Florida, the scutellation can be neglected. Although the light "*brooksi*" color pattern is frequent in southern Florida, it is found sporadically to the north as far as Polk and Osceola counties; likewise, the more distinct blotched pattern of *floridana*, while typical of central Florida, also occurs in southern Florida. Individuals of both types of color pattern have been collected together at several localities in the area of study.

Apparently the light king snakes differentiated in the prairie habitats as did *Coluber constrictor paludicola* and *Elaphe obsoleta rossaleni*; however, in *Lampropeltis* the differentiation was not accompanied by sufficient isolation for the evolution of homogeneous populations. The result is that there is a mosaic of *floridana* and *brooksi* color pattern types over much of south-central Florida, as well as intermediate individuals over most of the range of *brooksi*. Consequently, there is little justification in nomenclaturally recognizing a distinct population of *Lampropeltis getulus* in southern Florida. Blanchard's description of *floridana* antedates Barbour's of *brooksi*; thus *L. g. brooksi* should be considered a synonym of *L. g. floridana*.

In southern Florida *Lampropeltis getulus* is widely distributed on the mainland and is found in all principal habitats with the exception of salt marshes and mangrove swamps. It does not occur on the keys. According to local residents the species formerly was much more abundant than it is now. Locality records for 49 specimens are:

Broward County: southern part of county (1). *Collier County*: 2.3 mi. W Carnestown (1), Deep Lake (2), 3 mi. W Dade-Collier County line, Tamiami Trail (1), Monroe Station (1), 3 mi. W, 2 mi. N Monroe Station (1), 6 mi. W Monroe Station (1), 10.1 mi. SE Naples (2), Ochopee (1), 8 mi. E Ochopee (1), 21 mi. E Ochopee (2), Royal Palm Hammock (2), 7.2 mi. ESE Royal Palm Hammock (1). *Dade County*: Hialeah (1), 5 mi. NW Hialeah (1), Lemon City (1), Matheson Hammock (1), Miami (3), 19 mi. W, 2 mi. S of Miami (2), 20 mi. W Miami (3), 30-40 mi. W Miami (6), Paradise Key (4), 15.3 mi. SW Paradise Key (1), 20 mi. SW Paradise Key (1). *Monroe County*: Pinecrest (7), 6 mi. S Monroe Station (1).

Cemophora coccinea Blumenbach

In peninsular Florida there is a definite reduction in the number of red body blotches from north to south. This is accompanied by a trend toward broader blotches in the southern part of the peninsula. Ten specimens from Alachua and Marion counties have 15 to 25 (19.6) red blotches that usually extend laterally onto the second scale row, but sometimes onto the first or third. Nine individuals from Lake and Polk counties have 14 to 20 (17.8) red blotches that extend laterally onto the first or second scale rows. Twelve snakes from Dade and Collier counties have 12 to 19 red blotches; of these the blotches extend to the edges of the ventrals in six individuals, to the first scale row in four, and to the second in two.

In southern Florida *Cemophora* is found in pine woods, rosemary scrub, and in mesophytic hammocks. It does not inhabit the Everglades, nor is it found on the keys. Locality records for 19 specimens are:

Collier County: Marco Island (1). *Dade County*: (1), Coral Gables (3), 1.8 mi. W Florida City (1), Fort Biscayne (1), Lemon City (5), 7 mi. N Homestead (1), Miami (1), Ojus (1), Paradise Key (3). *Monroe County*: Pinecrest (1).

Tantilla coronata wagneri Jan

Six males have 133 to 139 (136.0) ventrals and 50 to 57 (53.5) caudals; three females have 141 to 146 (143.0) ventrals and 42 to 45 (44.0) caudals. All specimens from southern Florida have a pale reddish-tan dorsum, cream venter, and black head.

In southern Florida *Tantilla* has been collected only on the eastern rim and on Key Largo. Individuals have been found beneath rocks and boards in sandy soil in the pine woods, in hammocks, and in edificarian situations. The specimen from Key Largo was dislodged from a rotten stump. Locality records for 10 specimens are:

Dade County: Coconut Grove (1), Coral Gables (3), Kendall (1), Miami (4). *Monroe County*: Key Largo (1).

Natrix cyclopion floridana Goff

Twenty males from the Tamiami Trail west of Miami have 130 to 137 (133.6) ventrals and 70 to 76 (72.3) caudals; 20 females have 131 to 140 (134.7) ventrals and 63 to 72 (69.1) caudals. The color pattern of dark greenish-gray crossbars on a dull yellowish or grayish-brown ground color is indistinct in large individuals.

Three broods of young were born in captivity: 20 on 19 June, 20 on 21 June, and 42 on 28 July. Twenty individuals from the last brood had an average body length of 188.2 mm. and average tail length of 65.8 mm.

Our observations indicate that this species is confined to the Everglades and associated fresh-water habitats in southern Florida. Large individuals were encountered only at night when they could be found in numbers resting on mats of vegetation or swimming in the water in sloughs and side canals of the Tamiami Canal. Locality records for 177 specimens are:

Broward County: Hollywood (2). *Collier County*: Everglades (1), 5 mi. SE Naples (1). *Dade County*: Coconut Grove (1), 1.2 mi. SE Collier-Dade county line, Tamiami Trail (1), Hialeah (1), Lemon City (2), Loop Road (2), Miami (37), 17-20 mi. W Miami (7), 21-25 mi. W Miami (38), 27-30 mi. W Miami (5), 32 mi. W Miami (43), 37 mi. W Miami (1), 40 mi. W, 3.5 mi. NW Miami (20), Paradise Key (2), 20 mi. SW Paradise Key (1), Tamiami Trail west of Miami (8). *Monroe County*: 15 mi. W Dade County line on Loop Road (1), Pinecrest (3).

Natrix sipedon compressicauda Kennicott

Unfortunately, the large series of *Natrix sipedon* collected in southern Florida were not studied; these specimens are currently in the possession of L. Neil Bell. From the information available in our field notes only about ten percent of the specimens of *compressicauda* were erythristic. A female collected on 13 June 1953, south of Royal Palm Hammock, Collier County, gave birth to 21 young; among these were red individuals and black ones.

This subspecies has been collected throughout the Florida Keys and in mangrove and salt-marsh habitats on the mainland. Individuals from near Carnestown, Royal Palm Hammock, and 27 miles SW of Homestead may represent intergrades between *N. s. compressicauda* and *pictiventris*. Locality records for 109 specimens are:

Collier County: 2.1 mi. S Carnestown (9), Key Island, south Naples (2), Marco Island (1), 1.7 mi. SE Naples (8), 4.8 mi. S Royal Palm Hammock (22). *Dade County*: Biscayne Bay (4), Biscayne Key (3), 9 mi. E Florida City (1), 27 mi. SW Homestead (2), 40 mi. SW Homestead (1), Matheson Hammock (1), Virginia Key.

(1). *Monroe County*: Big Pine Key (3), Boca Grande Key (1), 1 mi. N Coot Bay (1), 1.5 mi. N Flamingo (1), Key West (34), Little Pine Key (3), Lower Matecumbe Key (3), Marathon, Key Vaca (1), Plantation Key (1), Stock Island (2), Summerland Key (3), West Lake (1).

Natrix sipedon pictiventris Cope

Most medium-sized and small adults have a light tan or yellowish-gray dorsal ground color with dark brown or black blotches. The labials normally are barred with black. Several individuals from the Everglades about 40 miles west of Miami have a peculiar coloration similar to that recorded here for UMMZ 108288: Labials orange, barred with red; head and dorsal ground color copper; lateral blotches one and one-half scales in width and reddish brown in color; belly yellow with red and brown markings. This individual is not an extreme example of color pattern difference; approximately fifty percent of the water snakes from that region are so colored.

Three females gave birth to young shortly after their capture; the size of the broods and dates of birth are 10 on 21 June, 32 on 28 June, and 17 on 7 July.

This water snake is found in fresh-water habitats throughout the southern part of the peninsula; it does not occur on the keys. It is most abundant in the Everglades, where large numbers of individuals are associated with *Natrix cyclopion floridana*. Locality records for 264 specimens are:

Broward County: 1.4 mi. W Hollywood (1). *Collier County*: Deep Lake (1), 7.4 mi. W Monroe Station (1), 1 mi. W Monroe Station (1), 7 mi. SE Naples (1), 10 mi. SE Naples (4), 12.7 mi. SE Naples (1), Royal Palm Hammock (2), 10.8 mi. ESE Royal Palm Hammock (1). *Dade County*: 4.2 mi. S Florida City (2), Hialeah (1), 40 mi. SW Homestead (63), Loop Road (1), Miami (13), 19 mi. W Miami (33), 19 mi. W, 2.1 mi. S Miami (1), 19 mi. W, 4 mi. S Miami (6), 20-22 mi. W Miami (7), 23-25 mi. W Miami (11), 26-28 mi. W Miami (4), 31-33 mi. W Miami (2), 36-40 mi. W Miami (5), 40 mi. W, 1-4 mi. NW Miami (13), Paradise Key (49), 15.1 mi. SW Paradise Key (18), 20 mi. SW Paradise Key (3), Tamiami Trail (4). *Monroe County*: 8 mi. W Dade County line, Loop Road (2), 5.5 mi. S Monroe Station (1), Pinecrest (8), 1 mi. SW Pinecrest (2), West Lake (2).

Natrix taxispilota Holbrook

Tropidonotus taxispilotus Holbrook, 1842, North American Herpetology, ed. 2, vol. 4, p. 35.

Natrix taxispilota taxispilota, Cliburn, 1956, Herpetologica, vol. 12, pt. 3, p. 200.

Ten males have 133 to 137 (135.4) ventrals and 75 to 79 (77.2) caudals; ten females have 128 to 132 (129.2) ventrals and 64 to 70 (67.4)

caudals. There is a marked sexual dimorphism in the number of dorsal scale rows; all females have a maximum of 33 rows, whereas eight males have 31, and two have 29. The largest specimen is a female with a total length of 1100 mm. The number of dorsal body blotches varies from 20 to 25 (22.5). In comparison with a series of six females from the Savannah River, Chatham County, Georgia, the specimens from southern Florida have fewer ventrals (average of 129.2 compared with 134.2), fewer body blotches (average of 22.5 compared with 25.5), and a darker ground color, that of the specimens from Georgia being orange tan, whereas individuals from southern Florida are grayish brown.

A litter of 16 young was born to a female with a body length of 880 mm. Of these, nine males have an average total length of 275.2 mm.; seven females, 265.3 mm. The position of the umbilical scar differs in the sexes. In the males the scar involves ventrals 118 to 124, and in the females it involves ventrals 106 to 118.

Natrix taxispilota has been collected only near flowing water or large bodies of water; apparently it avoids the sluggish canals and small shallow ponds in the Everglades. Schwartz (1950), upon first discovering this species at Taylor Slough near Paradise Key, suggested a means by which this snake may have reached southern Florida: "The presence of the snake in this area may be explained by the flooding of the Lake Okeechobee area and the southern drainage of the flood waters down the peninsula via the everglades. . . ." Locality records for 29 specimens are:

Collier County: Deep Lake (1), 1 mi. W Monroe Station (1). Dade County: ?Miami (2), Paradise Key (25).

Seminatrix pygaea cyclas Dowling

Six females have 114 to 121 (118.4) ventrals and 45 to 49 (47.3) caudals; one male has 118 ventrals and 55 caudals. All individuals have a ventral color pattern like that designated as "pattern 4" by Dowling (1950: 11). Neill (1951c: 54) reported a female from Broward County with a total length of 348 mm. A juvenile female from Dade County with a body length of 110 mm. has a prominent umbilical scar.

In southern Florida this species has been encountered only in the Everglades. Our specimens were secured from mats of water hyacinths in sloughs and small canals. Locality records for 7 specimens are:

Broward County: 20-Mile Bend (1). *Dade County*: 20.1 mi. W Miami (1), 23.1 mi. W Miami (1), 24.9 mi. W Miami (1), Paradise Key (2). *Monroe County*: Loop Road (1).

Storeria dekayi victa Hay

Twelve males have 135 to 147 (139.7) ventrals and 53 to 73 (62.4) caudals; 11 females have 140 to 149 (143.4) ventrals and 53 to 66 (57.3) caudals. Specimens from northern Florida and from the lower keys have fewer ventrals and caudals than do those from the southern part of the mainland (table 17).

TABLE 17

GEOGRAPHICAL VARIATION IN *Storeria dekayi victa* IN FLORIDA. COUNTS FOR SPECIMENS FROM NORTHERN FLORIDA WERE TAKEN FROM TRAPIDO (1944).

Locality	N	Sex	Ventrals	Caudals
Northern Florida	12	♂	131-140 (134.4)	52-62 (57.5)
	22	♀	130-148 (139.8)	46-56 (51.2)
Southern Florida	12	♂	135-147 (139.7)	53-73 (62.4)
	11	♀	140-149 (143.4)	53-66 (57.5)
Florida Keys	1	♂	128	54
	2	♀	128-135 (131.5)	49-50 (49.5)

The individuals from Big Pine Key differ in color from typical individuals from the mainland. One specimen (UMMZ 108212) in life had a venter of Tilleul Buff, lateral ground color of Light Drab, middorsal band of Hair Brown, and lateral neck ring of Vinaceous Buff. The black dots on the edges of the ventrals were reduced to small flecks. In preservative the ventral color faded to pale cream, the sides to light brown, the dorsum to a medium brown, and the neck stripe to light buff. Another individual from Big Pine Key (UMMZ 108211) resembled the above snake in life, except that it had a reddish tinge to the lateral color.

The largest male examined from southern Florida had a total length of 396 mm., and the largest female, 429 mm. A female with a total length of 309 mm. contained 11 young. A juvenile with a prominent umbilical scar had a total length of 114 mm.

Storeria dekayi has been found in the rocky pine woods on the eastern rim, in mesophytic hammocks, and in the mixed cypress-pine forests in the western part of the state. Its distribution in the Everglades probably is restricted to large hammocks and roadways. The species has been found on the lower keys, but not on the upper keys. Locality records for 41 specimens are:

Collier County: Carnestown (1), 9-12 mi. ESE Royal Palm Hammock (5). *Dade County*: Coral Gables (4), Lemon City (7), 5 mi. N Homestead (1), 7 mi. N Homestead (1), Miami (9), 27.5 mi. W Miami (1), 32.0 mi. W Miami (1), 42 mi. W Miami (1), Paradise Key (4). *Monroe County*: Big Pine Key (2), Cape Sable (1), No Name Key (1), Pinecrest (1), Sugarloaf Key (1).

Thamnophis sauritus sackeni Kennicott

Twenty males from the Everglades of Dade and Collier counties have 161 to 171 (166.0) ventrals and 116 to 122 (118.4) caudals; 20 females have 156 to 165 (160.6) ventrals and 109 to 119 (114.4) caudals. A single male from Big Pine Key has 163 ventrals and 140 caudals. The specimens from the southern part of the mainland resemble those from the northern part of the peninsula in the numbers of ventrals and caudals.

The ribbon snake is abundant throughout the southern part of the Florida peninsula. Its greatest abundance apparently is reached in the Everglades; nevertheless, the snakes are frequently encountered in and about nearly all fresh-water habitats. Most of the individuals were collected at night in the vicinity of frog choruses. *Thamnophis sauritus* has been observed feeding on *Bufo quercicus*, *Hyla cinerea*, and *H. squirella*. *Bufo terrestris* and *Pseudacris nigrita* have been found in the stomachs of preserved specimens.

Although commonly found throughout most of the peninsula, only one specimen of *T. sauritus* was found on the Florida Keys—Big Pine Key. Locality records for 86 specimens are:

Broward County: 2.2 mi. W Hollywood (1). *Collier County*: Carnestown (1), 3.6 mi. WNW Carnestown (1), 10.9 mi. WNW Carnestown (1), Deep Lake (4), 7.7 mi. E Monroe Station (1), 7 mi. SE Naples (1), 9.4 mi. SE Naples (1), Ochopee (1), Royal Palm Hammock (2), 8-10 mi. ESE Royal Palm Hammock (3), 11-12 mi. ESE Royal Palm Hammock (10), 17 mi. ESE Royal Palm Hammock (1). *Dade County*: 3.5 mi. SE Collier-Dade county line, Tamiami Trail (1), Coral Gables (1), 2 mi. E Florida City (1), Hialeah (1), Homestead (1), 20 mi. W Homestead (1), Lemon City (4), 2.3 mi. NW Medley (1), Miami (1), 17-19 mi. W Miami (3), 19 mi. W, 3 mi. S Miami (1), 21 mi. W Miami (1), 29-35 mi. W Miami (6), 40 mi. W Miami (3), Paradise Key (5), Tamiami Trail (3). *Monroe County*: Big Pine Key (1), Flamingo (3), 5.5 mi. S, 4.3-6.3 mi. E Monroe Station (4), Pinecrest (16).

Thamnophis sirtalis sirtalis Linnaeus

Thamnophis sirtalis is not abundant in southern Florida, and is rarely encountered in the Everglades. Most of the individuals were collected on the eastern rim, but a few were found in widely separated parts of the mainland. This snake does not occur on the keys, nor

has it been found in mangrove swamps or salt-marshes. Locality records for 37 specimens are:

Broward County: southern Broward County (2), 2 mi. S junction Ft. Lauderdale and Okeechobee-Miami roads (1). *Collier County*: Caloosahatchee River (1), Everglades (1), 5 mi. SE Naples (1), 6.7 mi. SE Naples (1). *Dade County*: Cutler (1), "Everglades" (1), Florida City (1), 3.4 mi. W Florida City (1), Lemon City (4), Long Pine Key (2), Miami (2), 13 mi. W Miami (1), 19 mi. W, 2.2 mi. S Miami (1), 36 mi. W Miami (1), 40 mi. W Miami (1), 2 mi. NW Miami Springs (1), Paradise Key (3), 4 mi. N Paradise Key (1), 6.1 mi. NE Paradise Key (1), 13.5 mi. SW Paradise Key (1), 20 mi. SW Paradise Key (1), between Paradise Key and Long Pine Key (1), South Miami (1), Tamiami Trail (3). *Monroe County*: Pinecrest (1).

Liodytes alleni Garman

Helicops alleni Garman, 1874, Proc. Boston Soc. Nat. Hist., vol. 17, p. 92.

Liodytes alleni lineapiatus Auffenberg, 1950, p. 13.

Eighteen males from the Everglades in Dade County have 117 to 124 (121.2) ventrals and 59 to 69 (62.8) caudals; 27 females have 121 to 129 (124.2) ventrals and 53 to 61 (58.0) caudals. Ten males and ten females from Alachua County have, respectively, averages of 119.1 and 121.1 ventrals and 59.4 and 53.2 caudals. The largest male from southern Florida has a total length of 507 mm., the largest female, 606 mm.

Auffenberg (1950) separated *Liodytes alleni* into a northern subspecies, *alleni*, characterized by having no ventral spots, and a southern subspecies, *lineapiatus*, characterized by the presence of spots on the venter. Individuals from various parts of the range may have no spots on the belly, spots only on the posterior half of the belly, or spots on the entire belly. One hundred and seventy-eight specimens from throughout the range of the species have been examined to determine the significance of the ventral spotting in delimiting a southern subspecies. The specimens were categorized as having the belly entirely spotted, spotted posteriorly, or unspotted; they are grouped geographically and compared in table 18. These data indicate that from north to south in peninsular Florida there is a tendency for more ventral spotting. No other characters are evident that will separate the northern and southern populations; there is a minor cline in ventrals and caudals, with individuals from the northern part of the peninsula having fewer scutes. Since the name *lineapiatus* has been applied only to a terminal population in a continuous-cline, and since less than 50 percent of the southern population is entirely spotted, the recognition of the subspecies *lineapiatus* seems unwarranted.

Consequently, *L. a. lineapiatus* Auffenberg should be considered a synonym of *Liodytes alleni* Garman.

TABLE 18

GEOGRAPHICAL VARIATION IN THE EXTENT OF VENTRAL SPOTTING IN *Liodytes alleni*.

Population *	N	Entirely spotted	Spotted posteriorly	Unspotted
Northern	76	0.0%	10.5%	89.5%
North-central	17	5.9	29.4	64.7
South-central	28	7.1	35.7	57.2
Southern	57	21.1%	43.9%	35.0%

* The northern population includes Marion County northward; north-central, Lake to Osceola counties; south-central, Okeechobee to Glades counties; southern, the area covered in the present report.

Two broods of young were born in captivity. A female with a body length of 372 mm. gave birth to four young on 28 June 1954; another from near Medley, Dade County, with a body length of 415 mm. gave birth to eight young on the same day. Of this last brood, two were males with total lengths of 170 and 178 mm.; the other six, females, had an average total length of 168 mm. The female had a complete row of midventral spots; of the young, five were unspotted, two had spots posteriorly, and one had spots the length of the venter.

Liodytes, along with *Seminatrix* and the aquatic salamanders *Notophthalmus*, *Pseudobranchius*, and *Siren*, is commonly associated with the introduced water hyacinth, *Eichhornia crassipes*. A few *Liodytes* have been collected in the water hyacinths, but most of the specimens from southern Florida have been found on the roads through the Everglades. On the night of 6 September 1953, during a heavy rain, eleven specimens were found within a distance of eight miles on the Tamiami Trail. On the clear, late afternoon of 23 June 1954, five individuals were found within a mile on the highway south of the Tamiami Trail.

This snake is found in the Everglades and associated aquatic habitats; it is absent from the keys. Locality records for 54 specimens are:

Broward County: junction Ft. Lauderdale and Okeechobee-Miami road (1), 30.8 mi. SSE South Bay (1). *Collier County*: 5.7 mi. W Monroe Station (1), 6.9 mi. E Monroe Station (1), 4.2 mi. N Naples (1), 3 mi. SE Naples (1), Royal Palm Hammock (1), 8 mi. ESE Royal Palm Hammock (1). *Dade County*: Hialeah (1), 7 mi. W Medley (9), Miami (1), 19 mi. W Miami (8), 19 mi. W, 1 mi. S Miami (3), 20.1 mi. W Miami (2), 20.8 mi. W Miami (1), 27-30 mi. W Miami (8), 31-35

mi. W Miami (5), 40 mi. W, 2.7 mi. NW Miami (2), 15 mi. SW Miami (1), 5 mi. E Paradise Key (1). *Monroe County*: 59 mi. W Miami (2), Pinecrest (1), 2.5 mi. W. Pinecrest (1).

Micrurus fulvius fulvius Linnaeus

Coluber fulvius Linnaeus, 1766, *Systema Naturae*, ed. 12, vol. 1, p. 381.

Micrurus fulvius barbouri Schmidt, 1928, p. 64.

The variation in color pattern in this species includes the presence or absence, as well as the size, of black markings in the red bands dorsally and ventrally, the number of black and red rings on the body, and the width of the yellow rings. The number of red bands varies from 9 to 18 throughout the peninsula; specimens from northern Florida have more bands than do those from the southern part of the peninsula (fig. 27). The distribution of black pigment in the red bands may consist of large black spots dorsally and ventrally along with small dark flecks; it may be restricted to small black flecks, or it may be absent entirely (fig. 28). The geographical distribution of these color pattern types is given in table 19. There is a tendency for the individuals from southern Florida to have less black pigment in the red bands; in many specimens the black spots are absent. Few individuals from northern or central Florida are devoid of such black spots. From northern Florida to the vicinity of Miami the width of the yellow rings dorsally varies from one to two and one-half scales. One individual from near Homestead has yellow rings that are less than one scale row in width. Of three specimens from Key Largo, one has no yellow rings, in another the rings are one-half scale row in

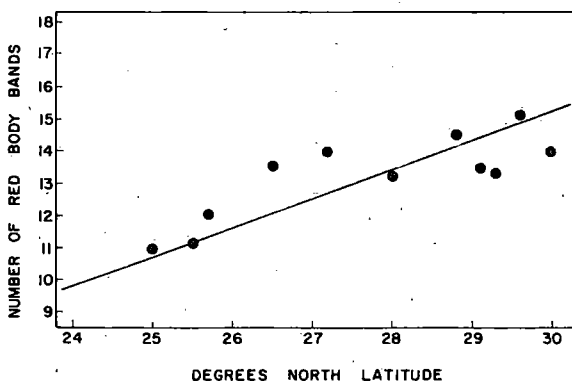


Figure 27.—Latitudinal gradient in the number of red body bands in *Micrurus fulvius* in peninsular Florida. Dots represent the mean number of bands for groups of specimens; the line was fitted by the method of least squares.

width, and in the last they are the width of a scale row. In all three the red and black bands are relatively few and wide. A specimen from Summerfield, Marion County, (ERA-WTN) has no yellow rings on the midbody.

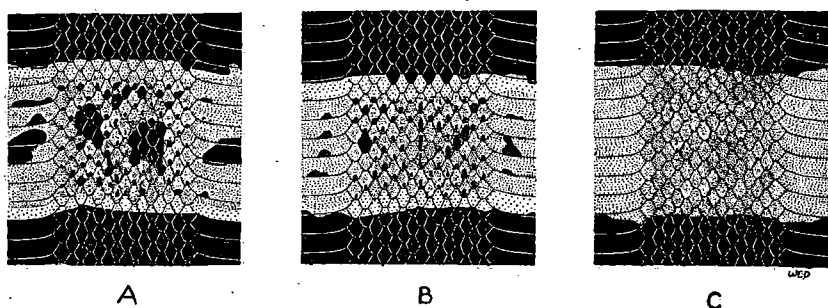


Figure 28.—Three color pattern "types" of *Micrurus fulvius* in peninsular Florida. A.—Large black spots in red rings (UMMZ 103925, Silver Springs, Marion County). B.—Black flecks in red rings (UMMZ 100675, DeLand, Volusia County). C.—No black in red rings (UMMZ 103175, Key Largo, Monroe County).

TABLE 19

DISTRIBUTION OF COLOR PATTERN "TYPES" OF *Micrurus fulvius* AS SHOWN IN FIGURE 28. NORTHERN, INCLUDES SPECIMENS FROM MARION COUNTY NORTHWARD; CENTRAL, INCLUDES SPECIMENS FROM LAKE COUNTY SOUTHWARD TO THE AREA OF STUDY; SOUTHERN INCLUDES THE AREA OF STUDY.

Population	N	Type "A"	Type "B"	Type "C"
Northern	126	77.0%	21.4%	1.6%
Central	39	66.7	30.7	2.6
Southern	32	57.6%	27.3%	15.1%

On the basis of few specimens Schmidt (1928) described the population of *Micrurus fulvius* in southern Florida as a subspecies, *barboursi*, characterized by having red rings not marred with black spots either ventrally or dorsally. In 22 specimens from the southern part of peninsular Florida, 19 have black markings in the red bands dorsally. Of these 16 have large black spots, whereas in the others only the tips of the scales are black. In the same 22 specimens, 16 have black spots ventrally and six do not. Of four specimens from the keys, two have black spots in the red bands ventrally and dorsally, and the other two have no black spots in the red. Thus, the characters used to distinguish two subspecies of *Micrurus fulvius* in peninsular Florida

are of no consequence. The additional material from southern Florida invalidates the recognition of *M. f. barbouri* Schmidt, which now should be placed in the synonymy of *M. f. fulvius* Linnaeus.

In the number of ventrals there appears to be a cline from a higher number in the north to a lower number in the south (table 20).

TABLE 20
GEOGRAPHICAL VARIATION IN *Micrurus f. fulvius* IN FLORIDA.

Locality	N	Sex	Ventrals	Caudals
Alachua County	19	♂	204-214 (210.5)	38-45 (41.7)
	17	♀	223-235 (226.9)	32-36 (33.3)
Dade County	9	♂	194-224 (207.0)	36-46 (43.0)
	12	♀	216-245 (225.0)	32-37 (34.6)
Upper keys	1	♂	189	42
	3	♀	186-205 (194.0)	28-45 (38.7)

The largest coral snake from southern Florida is a male with a total length of 950 mm.; the largest female has a total length of 926 mm. No juveniles were collected.

The coral snakes are partial to the mesophytic hammocks where they are found in the natural debris and in the loose soil and leaf mold. Individuals have been encountered under cover in vacant lots and in other ruderal situations. The species is found along the eastern rim and on Key Largo. The southernmost records for the western part of the peninsula are from north of the area of study—Immokalee, Collier County, and Sanibel Island, Lee County. Locality records for 32 specimens are:

Dade County: Chapman Field (1), Cutler (1), northern Dade County (1), Ft. Biscayne (1), Homestead (1), 7 mi. SW Homestead (1), 20 mi. SW Homestead (2), Lemon City (4), Miami (10), Redlands (2), Paradise Key (1), Pensuco (1), South Miami (2). *Monroe County:* Key Largo (4).

Agkistrodon piscivorus piscivorus Lacépède

The water moccasin is widely distributed in wet areas in southern Florida. Although found in cypress swamp, along streams, and in rock pits, it probably reaches its greatest abundance in the Everglades, where large numbers of individuals may be collected in certain areas. For the most part they are active at night. Aside from being found on roadways, they have been collected along margins of Everglades ponds, among cypress stumps, and resting on floating

masses of aquatic vegetation. The species has been found in mangrove swamps and salt marshes on the mainland and in mangrove swamps on the keys. Locality records for 66 specimens are:

Broward County: 22 mi. WNW Ft. Lauderdale (1). *Collier County*: 1.9 mi. E Carnestown (1), 7.4 mi. WNW Dade-Collier county line, Tamiami Trail (1), Monroe Station (2), 10.4 mi. E Monroe Station (1), 9.4 mi. SE Naples (1), 12.2 mi. SE Naples (1), 7 mi. ESE Royal Palm Hammock (2). *Dade County*: Coral Gables (2), Medley (1), Miami (6), 12 mi. W, 5 mi. N Miami (1), 17 mi. W Miami (1), 19 mi. W Miami (1), 35 mi. W Miami (3), 40 mi. W Miami (5), Paradise Key (3), 5 mi. SW Paradise Key (1), 20 mi. S Paradise Key (3). *Monroe County*: Bone Fish Key (1), Flamingo (1), Key Vaca (1), Key West (1), 50 mi. W Miami (7), 62 mi. W Miami (1), 5.4-6.0 mi. S Monroe Station (15), Pinecrest (2).

Sistrurus miliarius barbouri Gloyd

An abundant snake in the Everglades, the pigmy rattlesnake is seldom encountered in pinewoods or other dry habitats. At times of high water they are forced to higher ground, such as canal banks and roadways in the Everglades. On 20 September 1952, L. Neil Bell collected 12 individuals at a place 36 miles west of Miami; on 28 September he collected 15 more at the same locality. This snake has not been found in salt marshes, nor has it been found on the keys. Locality records for 65 specimens are:

Collier County: 8.5 mi. SE Naples (1), 11.9 mi. ESE Royal Palm Hammock (1). *Dade County*: Coral Gables (1), Homestead (2), 1 mi. N Homestead (1), 9 mi. N, 6 mi. W Homestead (2), Lemon City (5), Loop Road (2), Miami (3), 33 mi. W Miami (1), 35 mi. W Miami (1), 36 mi. W Miami (27), Paradise Key (6), 3 mi. SW Paradise Key (3), 10 mi. SW Paradise Key (1), 15 mi. SW Paradise Key (1), 25 mi. SW Paradise Key (1), Uleta (1). *Monroe County*: 46 mi. W Miami (1), Pinecrest (4).

Crotalus adamanteus Beauvois

This species avoids the wet prairies in southern Florida. It is most frequently found in pine woods on the eastern rim and to the west of the Everglades. Occasional individuals are found in mesophytic hammocks. Although not abundant, it is found throughout the chain of Florida Keys. Locality records for 31 specimens are:

Collier County: 13 mi. E Monroe Station (1), 4 mi. ESE Royal Palm Hammock (1). *Dade County*: Coral Gables (1), 2 mi. W Florida City (1), 4 mi. SW Florida City (1), Hialeah (1), Long Pine Key (1), Miami (10), 12 mi. NW Miami (1), 36 mi. W Miami (1), 3 mi. NW Opa-locka (1), Paradise Key (1). *Monroe County*: Big Pine Key (2), Key Largo (1), Key West (1), Little Torch Key (1), Planter Key (1), Sugarloaf Key (1), Summerland Key (2), Tortugas (1).

SUMMARY

This study is based on the examination of more than 10,000 herpetological specimens and is concerned with the distribution, variation, and life histories of 92 forms of amphibians and reptiles known to occur in southern peninsular Florida and the adjacent keys.

The area consists of Pliocene and Pleistocene formations with sand, marl, or muck soils supporting a variety of vegetation, and enjoying a tropical climate. The major habitats are: 1. Pine and scrub (xeric). 2. Tropical, oak, or palm hammocks (mesic). 3. Prairies and cypress savannas (alternohygric). 4. Rivers, canals, and ponds (hygic). 5. Mangrove swamps and salt marshes (halohygic). 6. Edificarian and ruderal.

The herpetofauna is composed of 68 native species, 12 introduced species, and 5 species of sea turtles. Each of the major habitats has an assemblage of species differing from those of other habitats. An analysis of the geographical distribution shows an impoverished fauna on the keys, with that of the lower keys being different from that on the upper keys, but having similarities with that on the peninsula to the north of the Everglades.

Eight native species are reported from southern Florida for the first time: *Hyla femoralis*, *Hyla gratiosa*, *Rana areolata aesopus*, *Gopherus polyphemus*, *Ophisaurus attenuatus longicaudus*, *Eumeces laticeps*, *Neoseps reynoldsi*, and *Pituophis melanoleucus mugitus*.

Two introduced species (*Bufo marinus* and *Ameiva ameiva*) are reported from definite localities in southern Florida for the first time; the record of *Ameiva* is new to the United States.

Two introduced species (*Sphaerodactylus argus argus* and *Leiocephalus carinatus virescens*) apparently are no longer extant in southern Florida. The former should be deleted from the herpetofaunal lists of the United States; the latter apparently still occurs in Palm Beach County, Florida. *Anolis sagrei ordinatus*, reported from Miami, is considered to be *Anolis sagrei stejnegeri*. Seven subspecies shown to be invalid and placed in synonymy are:

1. *Hyla cinerea evittata* = *Hyla cinerea*
2. *Anolis distichus floridanus* = *Anolis distichus distichus*
3. *Elaphe guttata rosacea* = *Elaphe guttata guttata*
4. *Elaphe obsoleta deckerti* = *Elaphe obsoleta quadrivittata*
5. *Lampropeltis getulus brooksi* = *Lampropeltis getulus floridana*
6. *Liodytes alleni lineapiatus* = *Liodytes alleni*
7. *Micrurus fulvius barbouri* = *Micrurus fulvius fulvius*

On the other hand, *Elaphe obsoleta rossalleni* is considered as a subspecies distinct from *E. o. quadrivittata*.

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